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IMPROVEMENTS FOR MURRELLS INLET, SOUTH CAROLINA. HYDRAULIC MODE--ETC(U)
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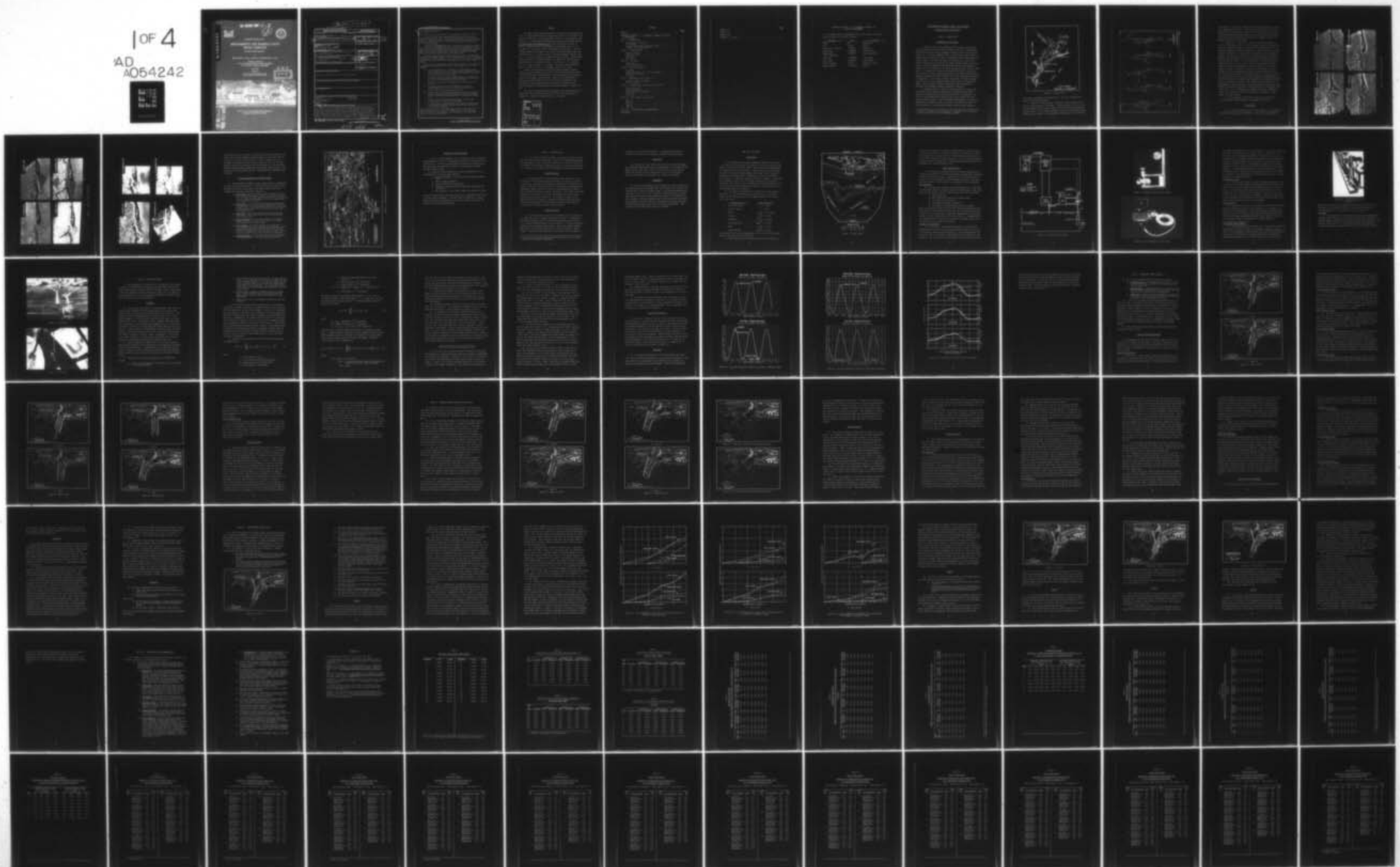

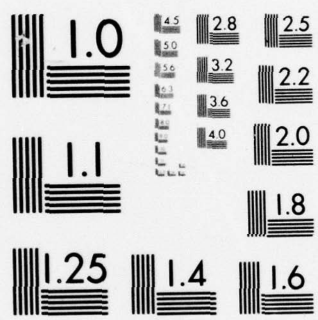

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TECHNICAL REPORT H-78-4

IMPROVEMENTS FOR MURRELLS INLET SOUTH CAROLINA

Hydraulic Model Investigation

by

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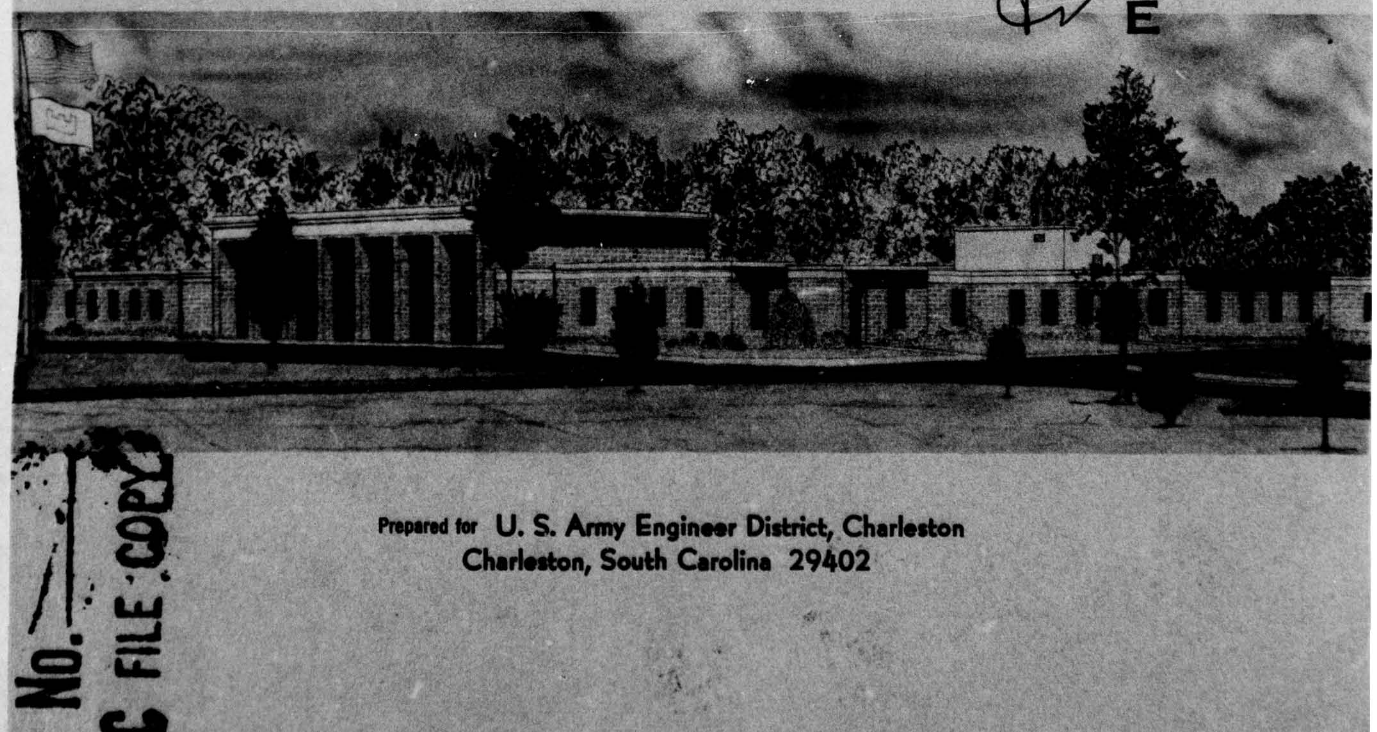
April 1978

Final Report



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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Murrells Inlet, located 13 miles southwest of Myrtle Beach, South Carolina, is a natural channel through a sandy beachline that conducts tidal flows between the Atlantic Ocean and a well-mixed lagoon of ocean salinity which has no source of freshwater inflow other than local surface runoff. The inlet provides passage from the ocean to docking facilities for charter craft, commercial fishing vessels, and private boats. However, due to the influx of sand into the inlet, an environment of shallow shifting-sand shoals → next Page

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20. ABSTRACT (Continued).

and breaking waves produces difficult and dangerous navigation conditions.

A project for the improvement and stabilization of the inlet was authorized in November 1971. A model study was performed to aid in preconstruction planning and design of structural solutions to the problem of providing a stabilized channel of sufficient depth and width with provisions for sand bypassing.

The Murrells Inlet fixed-bed model, constructed of concrete to scales of 1:200 horizontally and 1:60 vertically, accurately reproduced the lagoon and a region of the ocean near the inlet, an area of approximately 14.2 square miles. After a least-squares harmonic analysis of prototype tidal data for amplitude and phase of various tidal constituents, a successful hydraulic model verification was made based on the M_2 constituent.

The model study examined a variety of plans in order to optimize the alignment and spacing of jetties and the proper alignment of interior channels with respect to current patterns. Also, the effects of the plans on bay tidal elevations and tidal currents were determined as were the effects on wave heights.

Model testing concluded that plan 1H was the optimal plan for providing a stable entrance channel while providing for sand bypassing. The plan included:

a. A north quarrystone jetty composed of a 1,330-ft-long low weir section constructed to a +2.2 ft mlw elevation flanked by a 1,505-ft-long seaward section and a 518-ft-long shoreward section, each with a top elevation of +9.0 ft mlw.

b. A 3,330-ft-long south quarrystone jetty with a top elevation of +9 ft mlw. Also an 8-ft-wide fishing walkway will be constructed on the crest of the south jetty to el +10 ft mlw.

c. Sand dikes connecting the shoreward ends of the jetties to the dune line.

d. A 20-ft-deep deposition basin of 600,000-cu-yd capacity dredged adjacent to the low weir section on the inlet side.

e. A 300-ft-wide by 10-ft-deep entrance channel.

f. A 200-ft-wide, 10-ft-deep inner channel connecting the entrance channel to the mouth of Main Creek, where it joins a 90-ft-wide, 8-ft-deep channel that extends 13,590 ft to the Army Crash Boat Dock.

g. A 200-ft-wide, 10-ft-deep auxiliary channel connecting the entrance channel to the mouth of Oak Creek.

h. A training dike of variable height which flanks the lagoon side of the deposition basin in order to prevent tidal currents from passing through the basin.

The plan would not have a significant impact on tidal conditions, with maximum changes of 0.3 ft in bay tidal amplitudes, 0.2 ft in mean tide level, and 11 min in tidal phasing. Also there would be no significant change to the inlet's tidal prism.

PREFACE

The model investigation described in this report was authorized by the U. S. Army Engineer District, Charleston (SAC), on 23 May 1974. The study was conducted in the Wave Dynamics Division of the Hydraulics Laboratory, U. S. Army Engineer Waterways Experiment Station (WES), during the period June 1974-September 1977 under the general direction of Mr. H. B. Simmons, Chief of the Hydraulics Laboratory, and Mr. F. A. Herrmann, Jr., Assistant Chief of the Hydraulics Laboratory. The testing was conducted by members of the Oceans and Inlets Branch under the direction of Dr. R. W. Whalin, Chief of the Wave Dynamics Division, and Dr. C. L. Vincent, Chief of the Oceans and Inlets Branch. Project Engineers were Mr. W. D. Mallard and MAJ F. C. Perry, CE. The tests were conducted with the assistance of Mr. J. W. McCoy, Dr. D. L. Durham, Mr. K. A. Turner, and Mr. R. E. Ankeny. This report was prepared by MAJ F. C. Perry, CE, Mr. W. C. Seabergh, and Mr. E. F. Lane.

Messrs. Jack Lesemann, Jerry Durrin, Thurmon Morgan, Richard Connell, Clarence Mathews, Austin Owen, John Carothers, and Van Statts of SAC; Jim Robinson, Richard Bonner, John Lyon, Chris White, George W. Allen, John Lockhart, and Trofton Fleetwood of the South Atlantic Division; and Neill Parker of the Office, Chief of Engineers, were participants in conferences during the course of the model study. District Engineer of SAC during the study was COL Harry S. Wilson, Jr., CE.

Directors of WES during the investigation and the preparation and publication of this report were COL G. H. Hilt, CE, and COL John L. Cannon, CE. Technical Director was Mr. F. R. Brown.

CONTENTS

CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI)
UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
inches	25.4	millimetres
feet	0.3048	metres
miles (U. S. statute)	1.609344	kilometres
square feet	0.09290304	square metres
square miles (U. S. statute)	2.589988	square kilometres
cubic feet	0.02831685	cubic metres
cubic yards	0.7645549	cubic metres
feet per second	0.3048	metres per second
degrees (angle)	0.01745329	radians

IMPROVEMENTS FOR MURRELLS INLET, SOUTH CAROLINA

Hydraulic Model Investigation

PART I: INTRODUCTION

Description of Prototype

1. Murrells Inlet is an unimproved inlet through the beachline of South Carolina about 19 miles* northeast of the city of Georgetown, South Carolina, and 13 miles southwest of Myrtle Beach, South Carolina (Figure 1). The inlet provides access to a well-mixed tidal lagoon of ocean salinity that has no source of freshwater inflow other than local surface runoff. The inlet maintains its existence due to the tidal currents generated by the ocean tidal height variation (mean ocean tide range 4.8 ft) which generates ebb and flood currents that transport a tidal prism of 253 million cu ft flowing through the inlet during a tidal cycle. In opposition to the tidal currents that tend to maintain an open inlet are littoral currents generated by wind waves carrying sand along the shoreline into the vicinity of the inlet causing the formation of sand shoals. These shoals prevent easy ingress and egress through the inlet due to their ephemeral nature with respect to location and depth. Waves breaking on these shallow shoal areas contribute to difficult and sometimes dangerous navigation conditions.

2. Murrells Inlet is a part of the Grand Strand, a resort area consisting of sandy beaches, sand dunes, marshlands, and maritime forests stretching from the North Carolina border to Winyah Bay. The inlet is used extensively by charter craft, private boats, and commercial fishing vessels. With navigational improvements, it is anticipated that the commercial use of the inlet will increase in order to provide seafood to the surrounding region, especially with regard to

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* A table of factors for converting U. S. customary units of measurement to metric (SI) units is presented on page 4.

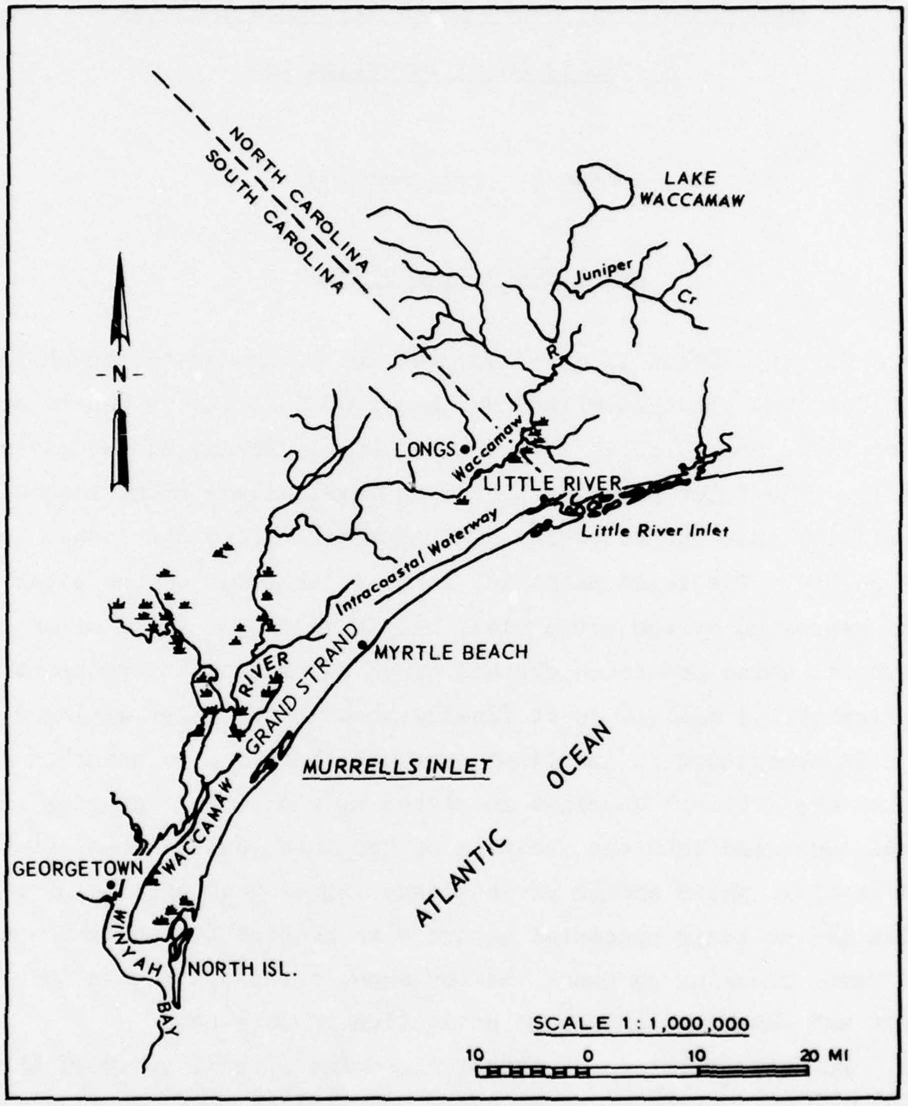


Figure 1. Location map

the region's expanding resort development. This will stimulate the charter fishing boat business.

3. Reports[1] of the existence of Murrells Inlet go back to the days of early pioneers in the 1700's. Old maps indicate the inlet also has been called Morralls Inlet; however, the currently accepted name is Murrells Inlet. U. S. Coast and Geodetic Survey (now the National Ocean Survey) charts (Figure 2) show high-water shorelines for five different

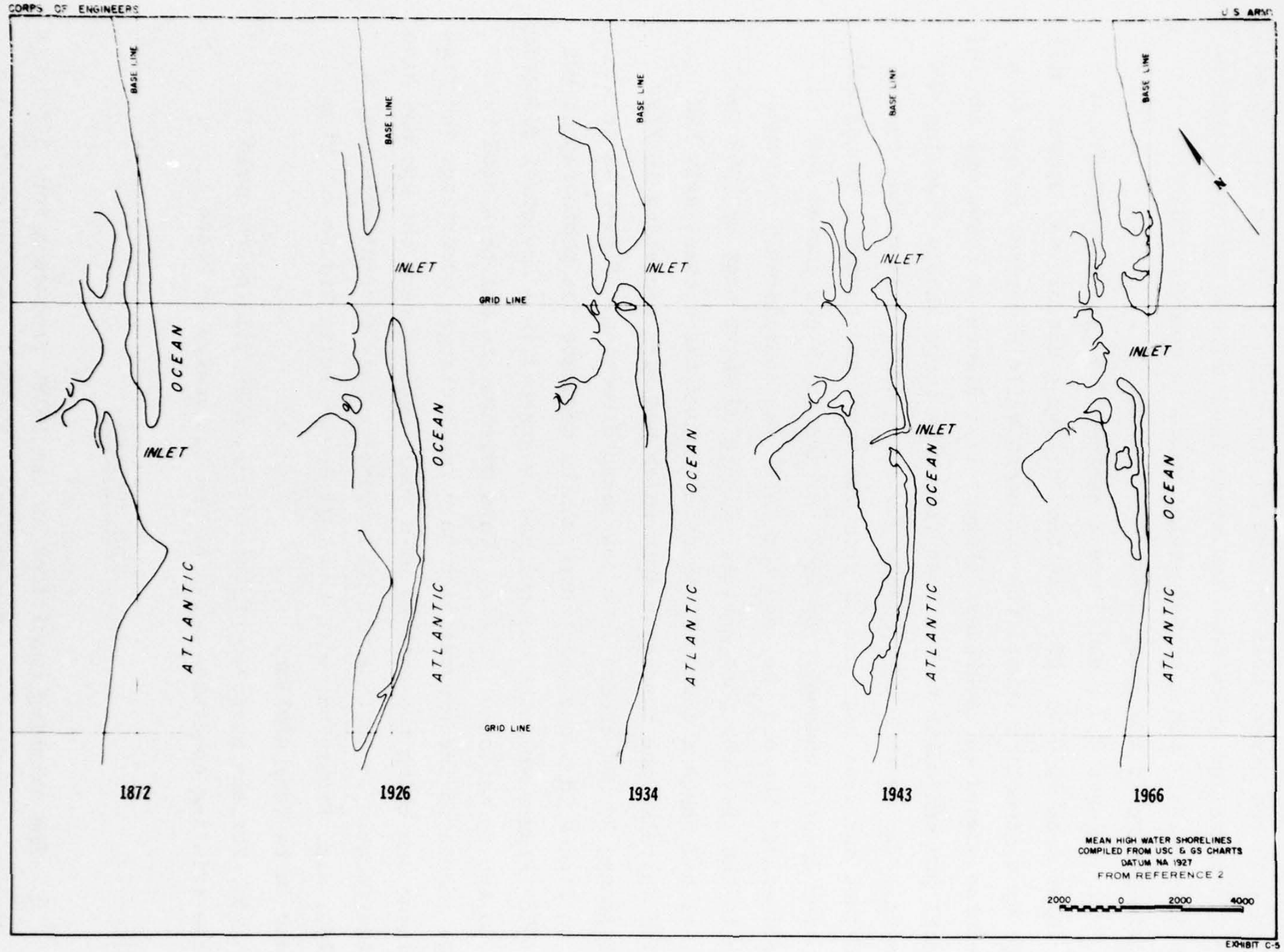


Figure 2. Geomorphic changes at Murrells Inlet

time periods.[2] From 1872 to 1926, the inlet migrated upcoast, or northeast, approximately 7,000 ft. The 1943 survey indicates a dual inlet system with the newer inlet located in the vicinity of the 1872 inlet. The 1966 shoreline shows that the newer inlet closed and the northernmost inlet (1943) had migrated south, which in summary indicates the dynamic nature of the study area.

4. Figures 3, 4, and 5 are a series of aerial photographs of the inlet from 1950 to 1975. In the following discussion, upcoast will refer to a direction toward the northeast while downcoast refers to a direction toward the southwest (Figure 1). Figure 3a shows one central channel perpendicular to the beachline with large shoals flanking the channel. Two years later (Figure 3b) a secondary channel had formed downcoast and sand had come in from the north and formed a hooked spit into the upcoast channel. By 1957 (Figure 3c) a new curved spit had developed off the old one, and the inlet was considerably narrower than in the previous photographs. Figure 3d shows that by 1963 the channel had taken a downcoast orientation and the upcoast spit had filled in; also the downcoast spit which had been accreting in Figures 3b and 3c had eroded in a downcoast direction. Figure 4a is similar to Figure 3d since only three months separate the photographs; but by 1968 (Figure 4b), the channel had lengthened in a downcoast direction due to the formation of shoals. This orientation has persisted to a large degree to the present with only small changes occurring, the predominant one being the cutting of a small channel near the upcoast side of the inlet. It is interesting to compare this current orientation (1975), e.g. Figure 5d, with the 1872 shoreline in Figure 2. They appear to be very similar.

5. For the purposes of this study, 1974 will be referred to as the existing condition shown by the bathymetry in Plate 1.

The Problem

6. The existing conditions at the inlet produce a very difficult and dangerous navigational environment. A public meeting produced a

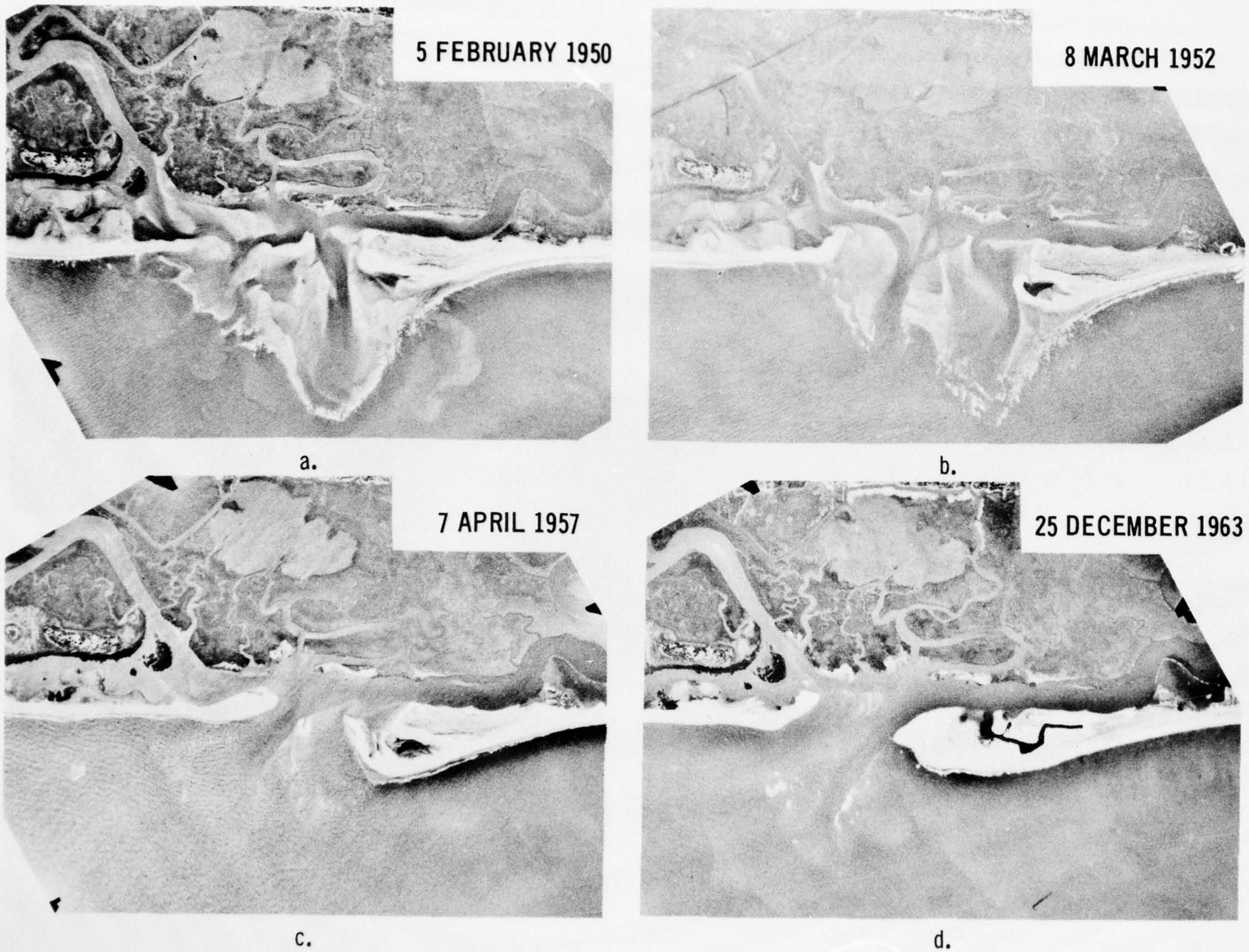
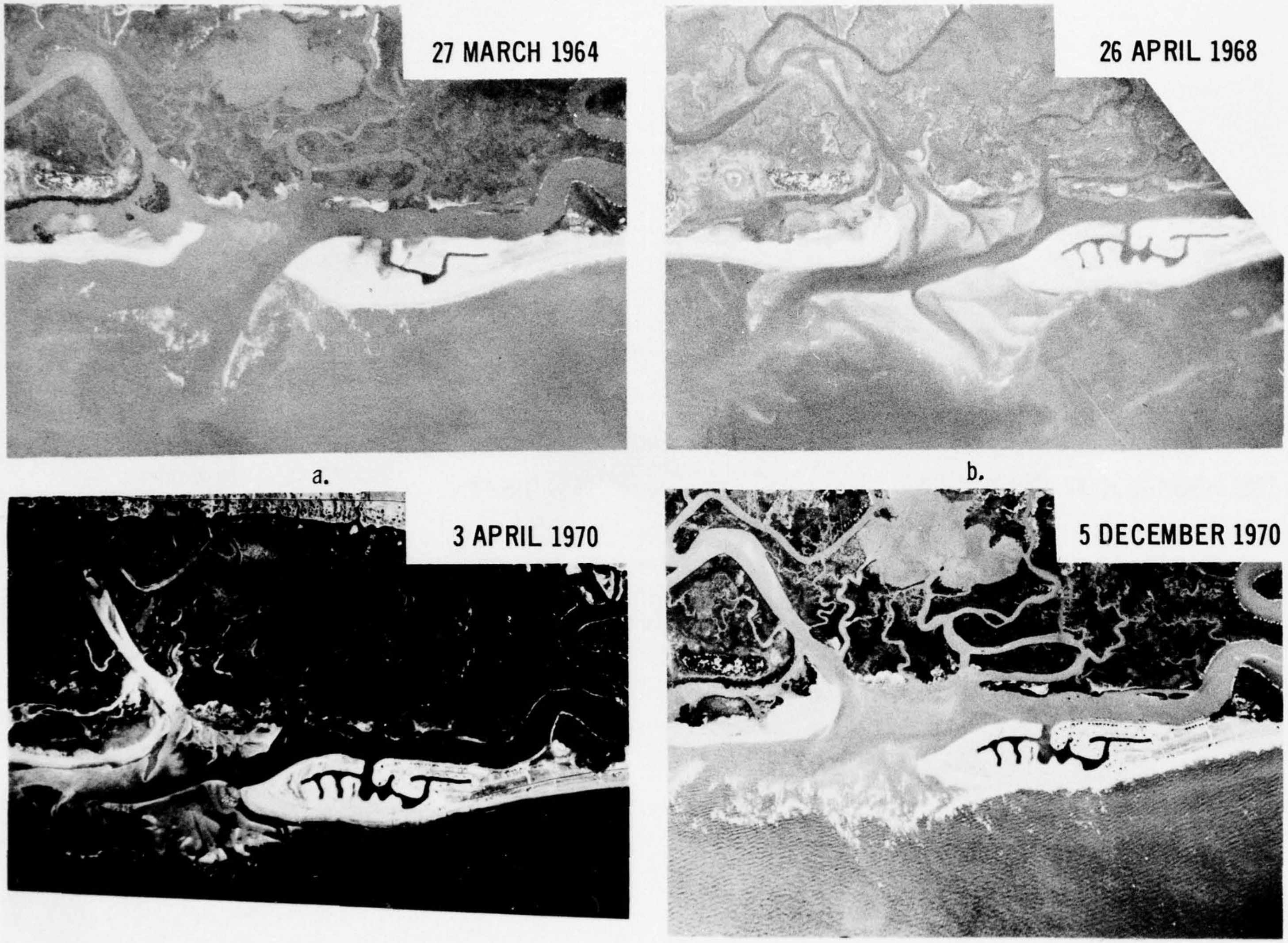


Figure 3. Murrells Inlet, 1950-1963



a. b. c. d.

Figure 4. Murrells Inlet, 1964-1970

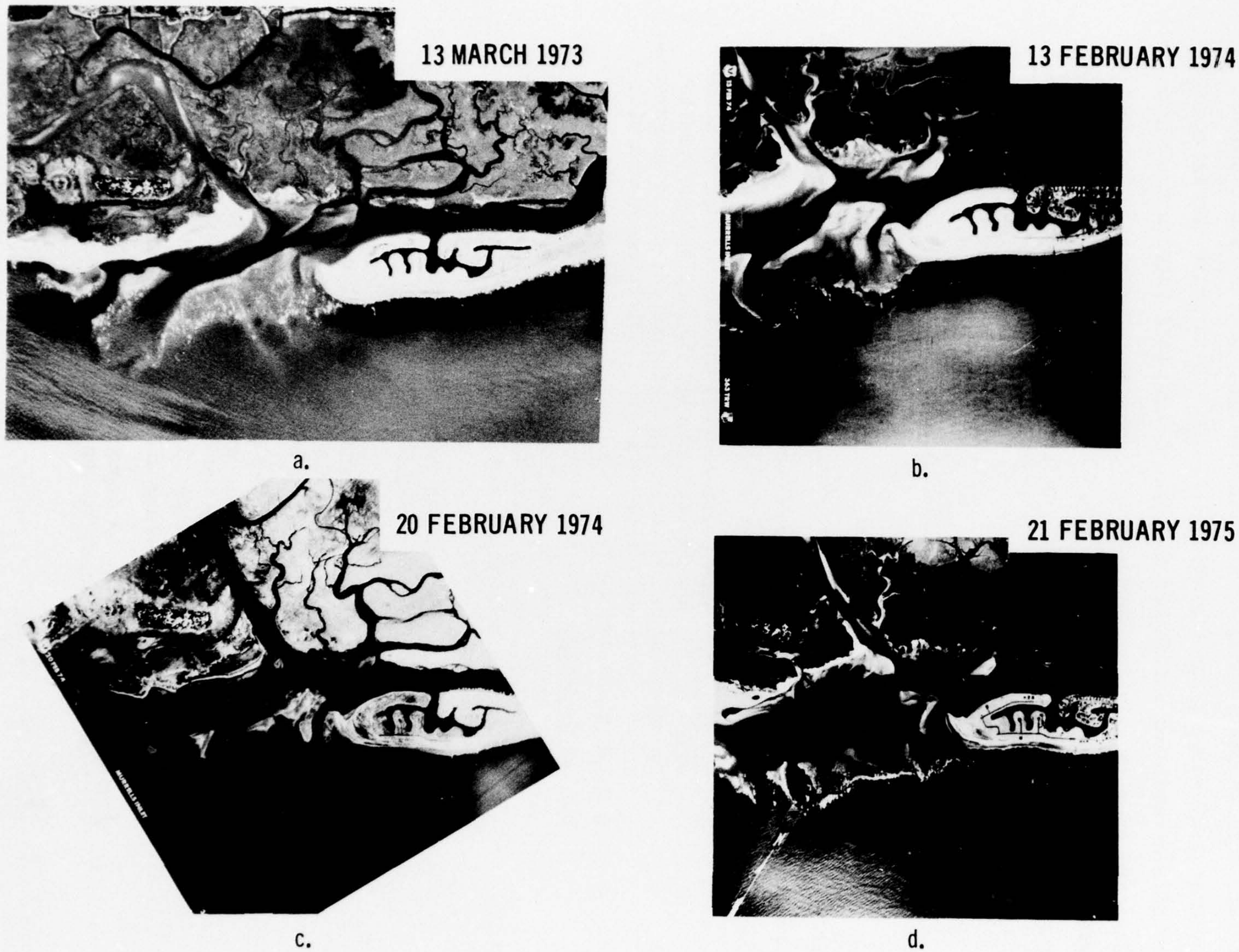


Figure 5. Murrells Inlet, 1973-1975

considerable volume of evidence illustrating increasing problems at the inlet, such as boats damaged by running aground on the shoals and the necessity of waiting for high tides in order to navigate the inlet, sometimes requiring waiting in the open ocean until late in the night. Economic studies have indicated that the existence of a safe and navigable protected entrance channel would have great economic value to the region by increased usage by charter fishing craft and commercial fishing boats.

Proposed Improvements (Premodel Study)

7. The preliminary (premodel study) proposed plan of improvement[2] provides for the construction of a north jetty with a low weir section and deposition basin, south jetty, sand dikes, entrance and inner channels, and recreation facilities (Figure 6).

- a. *North jetty.* The north jetty would be composed of a low weir section approximately 1,300 ft long and constructed to a +2.2 mean low water (mlw) elevation, and a quarrystone section extending approximately 1,500 ft oceanward with a top elevation of +9 ft mlw.
- b. *South jetty.* The south jetty also would be constructed from quarrystone and would extend approximately 2,300 ft oceanward with a top elevation of +9 ft mlw. An 8-ft-wide fishing walkway would also be constructed on the crest of the south jetty.
- c. *Sand Dikes.* Sand dikes would be constructed from the inner ends of both stone jetties to the existing dune line at +10 ft mlw.
- d. *Entrance channel.* The entrance channel would extend inland from the -12 ft mlw ocean contour and would be 300 ft wide and 12 ft deep at mlw.
- e. *Inner channel.* The inner channel, 90 ft wide and 10 ft deep at mlw, would extend from the entrance channel through Main Creek to the old Army Crash Boat Dock, a length of approximately 15,400 ft, where it would terminate with a 300-ft-long and 150-ft-wide turning basin.
- f. *Deposition basin.* A deposition basin would be dredged to -12 ft mlw adjacent to the weir on the north jetty.

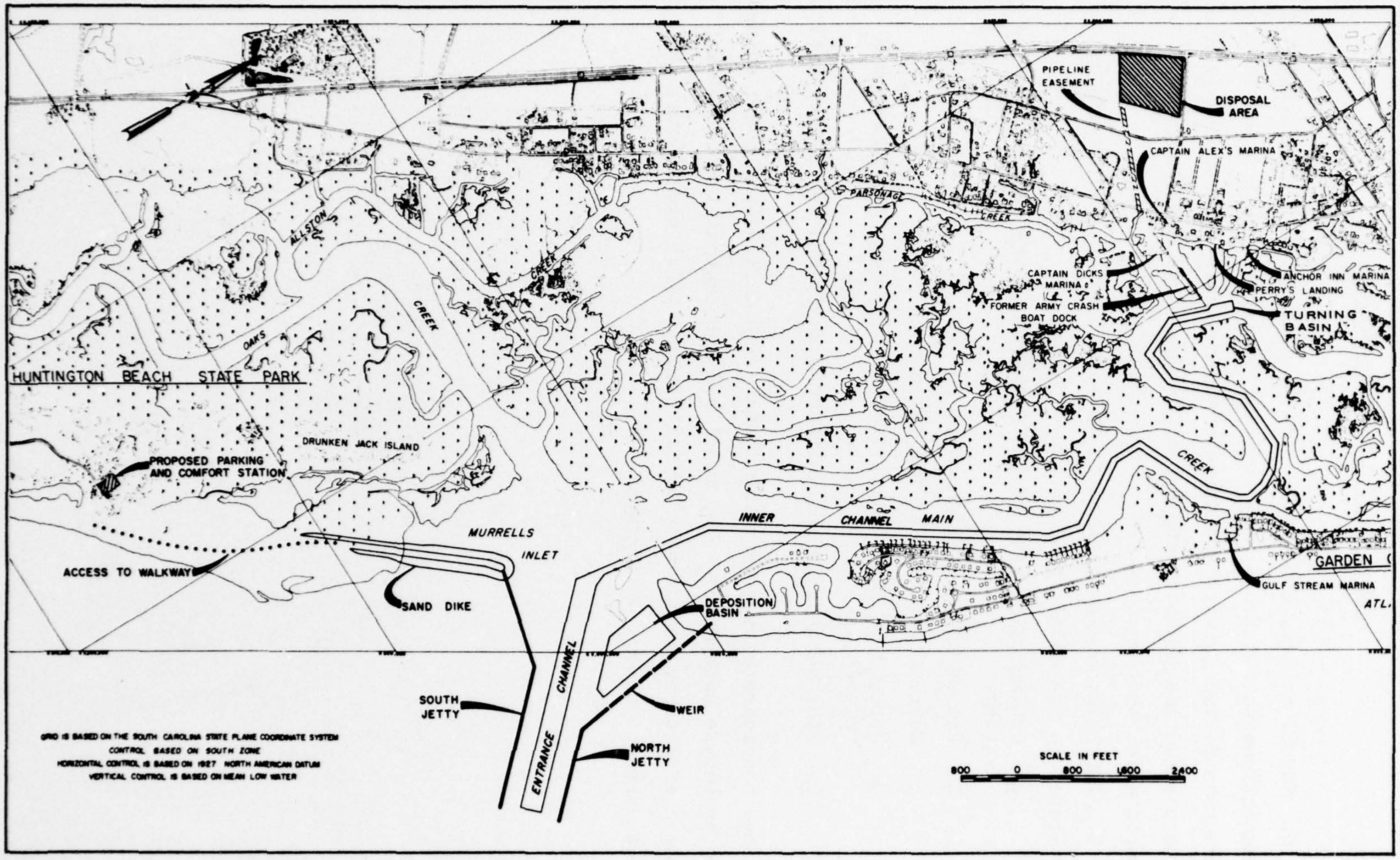


Figure 6. Proposed improvements

Purpose of the Model Study

8. The U. S. Army Engineer District, Charleston (SAC), submitted recommendations to the U. S. Army Engineer Division, South Atlantic, for construction of two jetties and appropriate channels at Murrells Inlet. The preconstruction planning and design of the structure required hydraulic model testing.

9. Important design parameters and other considerations to be investigated in the model study included:

- a. Optimum alignment of the jetties and the spacing between them.
- b. Proper channel alignment
- c. Current patterns at the entrance.
- d. Effects on the tidal prism and bay tidal elevations and velocities.
- e. Wave heights in the entrance channel and deposition basin.

The above considerations were investigated with a fixed-bed model molded to the prototype bathymetry. The model had the capability to define hydraulic effects by measurement of velocities, tidal elevations, and surface current pattern photographs.

PART II: PROTOTYPE DATA

10. In order to provide accurate, up-to-date prototype data with which to verify the physical model, a special field measurement program was undertaken in 1974. Tides were observed for a duration sufficient to perform a tidal harmonics analysis, velocities were observed throughout a complete tidal cycle, and a new bathymetric survey was conducted.

Tidal Elevations

11. Prototype data on tidal elevations were obtained at seven locations in the tidal lagoon and one location on the open coast north of the inlet. The gages were installed, operated, and analyzed by personnel of National Ocean Survey (NOS) of the National Oceanographic and Atmospheric Administration for a period of approximately six months. Gage locations are shown in Figure 7 and Plate 1, and results of the NOS analysis of these data for the tidal constituents at the open-coast gage (gage 8) are shown in Table 1. As indicated in Table 1, the Murrells Inlet tidal regime is dominated by the principal lunar semidiurnal consitutent M_2.* The M_2 variance represents approximately 90 percent of the tidal variance in Murrells Inlet.

Tidal Velocities

12. Prototype tidal velocities were measured for a 14-hr period on 1 May 1974 at the six ranges illustrated in Plate 2. Depending on the channel width and depth, currents were measured every 30 min for 1 to 3 stations (marked by buoys) on each range at 1 to 3 water depths per station (surface, middepth, and bottom). Bottom and surface measurements were 2 ft above the bottom and 2 ft below the surface, respectively. Price-type current meters were used with a direct readout on

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* For convenience, symbols and unusual abbreviations are listed and defined in the Notation (Appendix A).

the boat for both speed and direction. A hand-operated winch was installed on the boat for raising and lowering the current meters.

Salinities

13. During the tidal velocity data collection, salinity samples were obtained simultaneously with the observation of velocities at each depth, station, and range. Results indicated that the bay was well mixed with salinities nearly equivalent to the local ocean water salinity, differing by only as much as 1.6 parts per thousand.

Bathymetry

14. Part of the bathymetric data required for model construction was obtained by SAC in March-May 1974, and consisted of a survey of the offshore area at 500-ft intervals normal to the shore-established baseline (Plate 1) out to the -30 ft contour, from which point the topography was taken directly from existing NOS charts. The channels also were surveyed. Aerial photography (color infrared and black and white) was obtained at low water (while the gages were installed) from which the preceding high-water line could be clearly distinguished. Spot elevations in the tidal lagoon were also obtained.

PART III: THE MODEL

Description

15. The Murrells Inlet model accurately reproduced an area seaward to the -22 ft mlw contour and bayward to include the entire tidal lagoon to an elevation of +10 ft mlw. This area covered approximately 14.2 square miles in the prototype. A small portion of the northeast extremity of the lagoon, approximately 0.42 square mile in area, was schematized and folded back to conveniently fit into the available shelter space. A layout of the model is shown in Figure 7. The bathymetry oceanward of the -22 ft mlw contour was molded artificially to compensate for refraction due to bathymetric variations seaward of this contour which could not feasibly be installed in the model because of the extremely large area required.

16. The model was constructed to linear scale ratios, model to prototype, of 1:200 horizontally and 1:60 vertically. From these scales, the following relations were computed based on the Froudian law of similitude.

Characteristic	Scale Relations
Horizontal length	$L_H = 1:200$
Vertical length	$L_V = 1:60$
Volume	$L_H L_H L_V = 1:2,400,000$
Velocity	$L_V^{1/2} = 1:7.746$
Discharge	$L_V^{3/2} L_H = 1:92,880$
Time--tidal wave	$L_H L_V^{-1/2} = 1:25.82$
Slope	$L_V / L_H = 1:3.333$
Time--wind wave	$L_V / L_V^{1/2} = 1:7.746$

One prototype tidal cycle (semidiurnal) of 12 hr and 25 min was reproduced in the model in 28 min and 52 sec.

17. South Carolina grid coordinates were used for horizontal

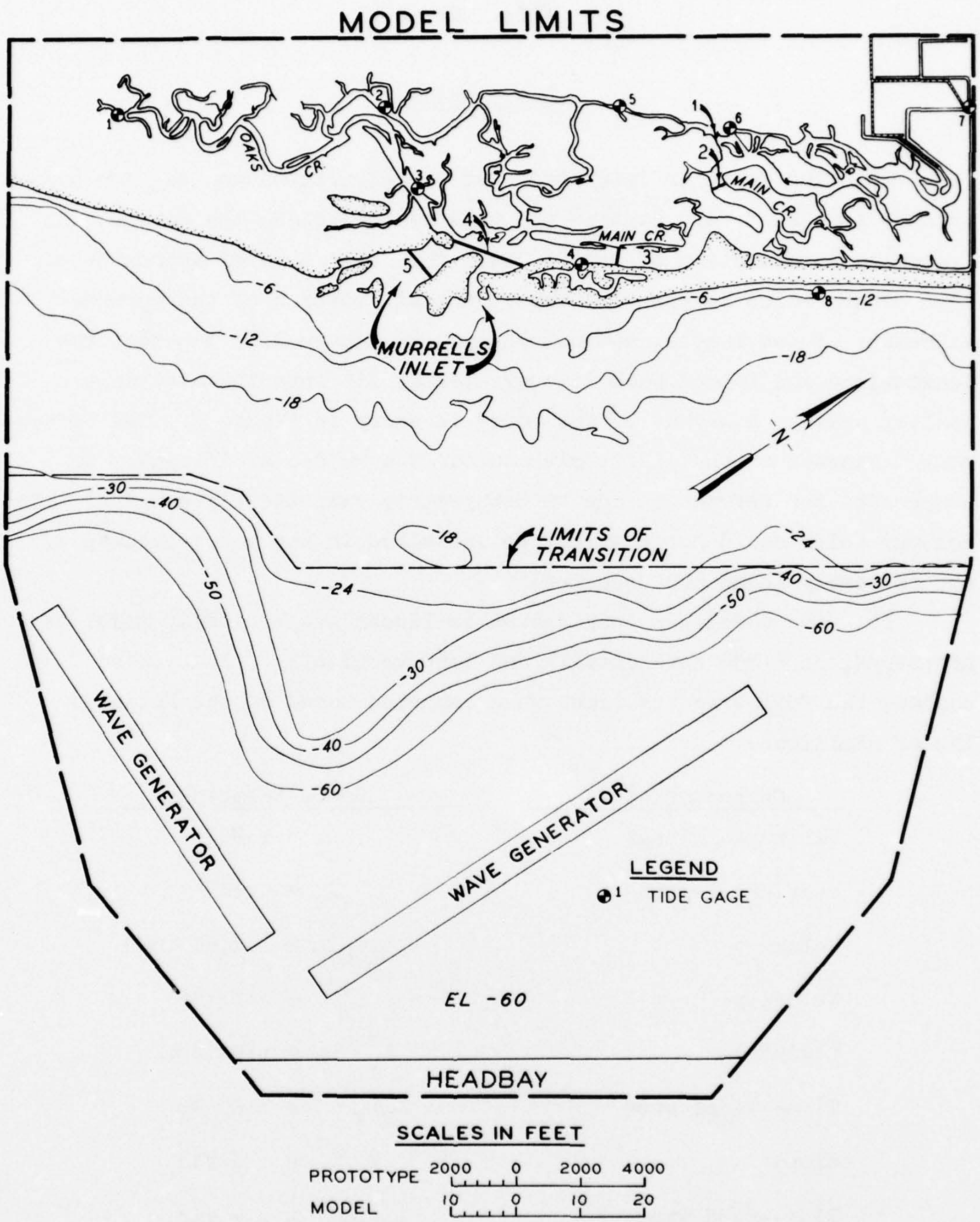

Figure 7. Model layout

control and the 1929 mean sea level datum was used for vertical control for model construction. The model was molded in concrete grout using metal templates for primary control. These templates were secured to the concrete facility floor and spaced from 1 to 3 ft apart as required to give adequate representation. The model was molded accurately to the March-May 1974 survey furnished by SAC.

Model Appurtenances

18. The model was equipped with the necessary appurtenances to reproduce and measure all pertinent phenomena including tidal elevations, current velocities, and waves. Apparatus used in connection with the reproduction and measurement of these phenomena included a tide generator and recorder, velocity meters, wave generators, and tidal gages.

Tide generator

19. The model was equipped with a WES-designed (U. S. Army Engineer Waterways Experiment Station) automatic tide generator, shown schematically in Figure 8. The five major components of the system were:

- a. The program cam.
- b. The differential amplifier and power supply.
- c. The bubble tube positioner.
- d. The hydraulic-pneumatic amplifier.
- e. The hydraulic cylinder and control gate assembly.

When the differential amplifier detected a difference between the water level sensed by the bubble tube positioner and the desired water level indicated by the program cam, a signal was transmitted to the hydraulic cylinder to alter the position of the control gate. A feedback control loop allowed time for the model to respond to the change in gate position before the next signal was accepted.

Current velocity meters

20. Velocities of tidal generated currents in the model were measured with miniature Price-type current meters (Figure 9) and with electromagnetic current meters (Figure 10). The Price-type meter cups were about 0.04 ft in diameter, representing 2.4 ft vertically in the prototype. The center of the cup was about 0.045 ft from the bottom of

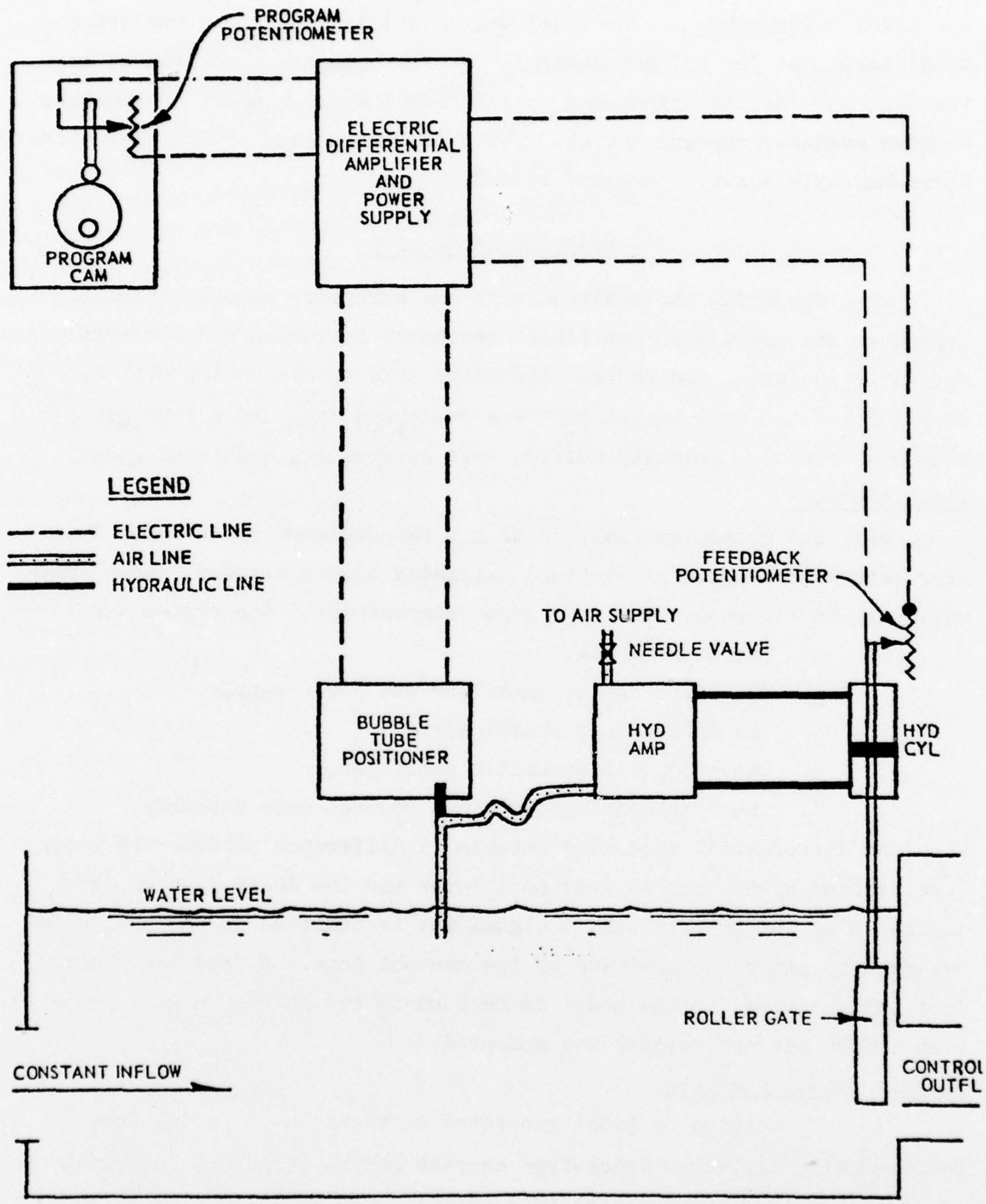

Figure 8. Automatic tide generator

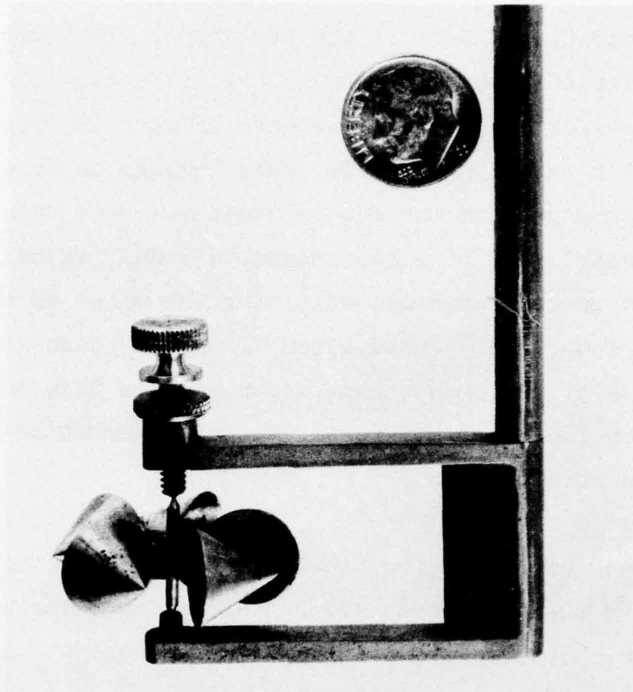

Figure 9. Miniature current velocity meter

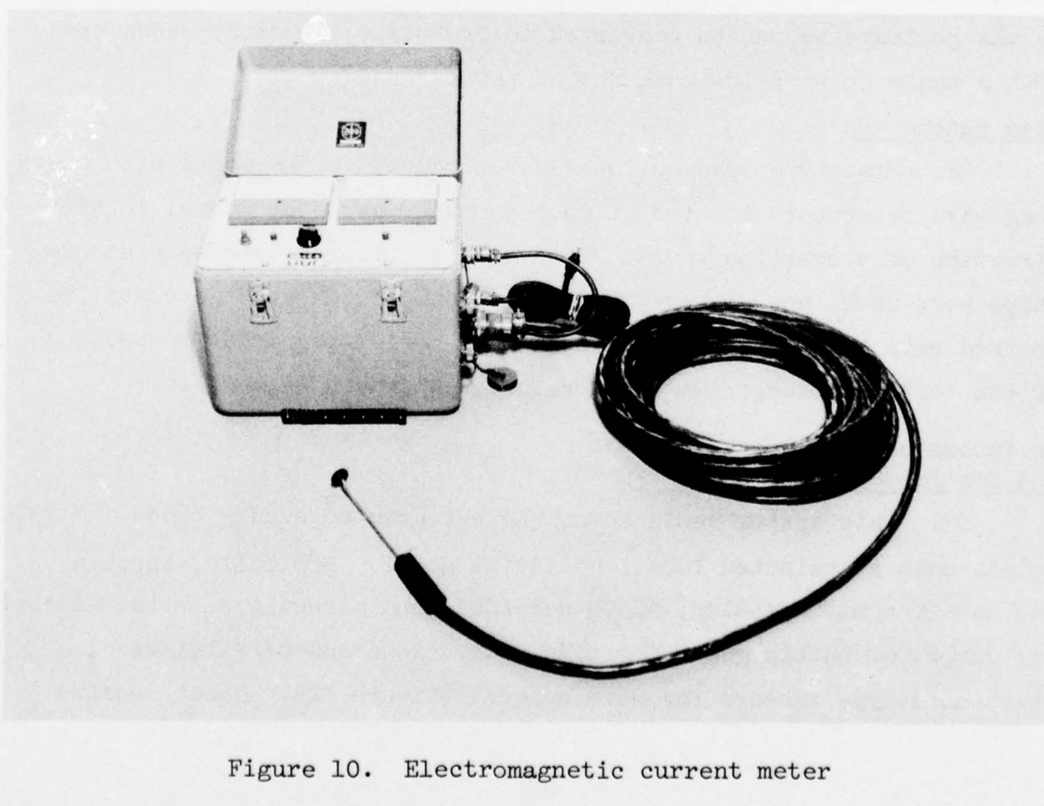

Figure 10. Electromagnetic current meter

the frame, representing 2.7 ft in the prototype. In a vertical plane the entire meter occupied a space of about 2 by 21 ft when scaled to the prototype. The electromagnetic flowmeters (Figure 10) were used as a secondary means of gathering velocity data because of development imperfections but showed promise for future studies. This type of meter operates on Faraday's law of electromagnetic induction by generating a magnetic field in the water and utilizing the water as the electrical conductor. The instrument sensed water flow in a plane normal to the longitudinal axes of the probe, and presented this flow as two orthogonal components on the panel meters for visual observation and as analog voltages for a separate recorder.

Photographic system

21. Surface current velocities were recorded photographically by a number of 8- by 10-in. cameras secured above the water surface of the model, and their shutters were tripped simultaneously by an electronic timer. An electronic strobe light was flashed near the end of each exposure so that a bright spot was recorded near the tip of the float streak, indicating the direction of movement. Lengths of streaks shown on the photographs can be converted to prototype velocities when used with a scale shown below each set of photographs.

Wave generators

22. Prototype wave action was reproduced in the model with 60-ft-long wave generators located in such a manner as to be normal to the direction of prevailing waves. Two vertical plunger-type wave generators were used, and either could be adjusted quickly to generate the desired wave height, wavelength, and wave period required. A section of the vertical plunger wave generator is shown in Figure 11.

An Automated Data Acquisition and Control System (ADACS)

23. This system designed at WES was used to secure tide- and wave-height data at selected locations in the model. Basically, through the use of a minicomputer, ADACS recorded onto magnetic tape the electrical output of bubble gages for tidal elevations and parallel-wire, resistance-type sensors for wave heights (Figure 12). These sensors

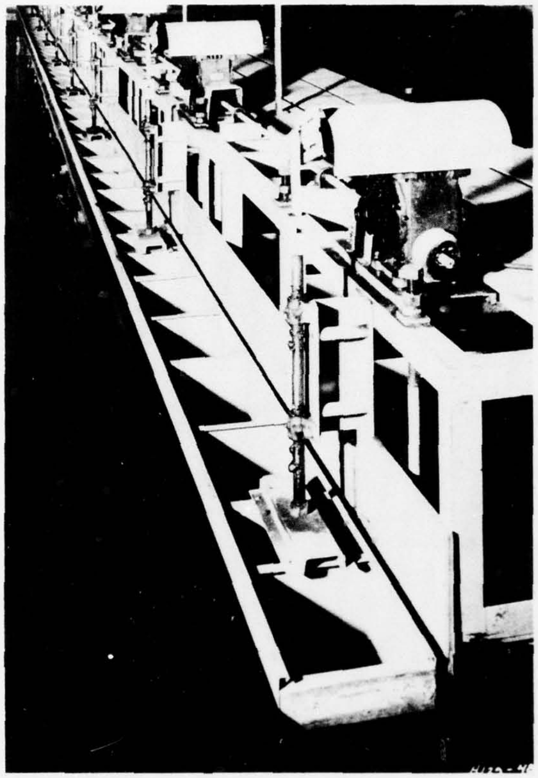

Figure 11. Vertical plunger wave generator

measured the change in water-surface elevation with respect to time. The magnetic tape output of ADACS was then analyzed by computer. A detailed discussion of this system is found in Reference 3.

Tide gages

24. Tidal heights in the Murrells Inlet model were measured by a "bubbler system" (Figure 13) or gage that measured small hydrostatic pressure changes associated with changes in model tidal elevations. The bubbler system consisted of a high precision pressure transducer, a scanivalve device for sequencing input ports, and 48 pressure inputs.

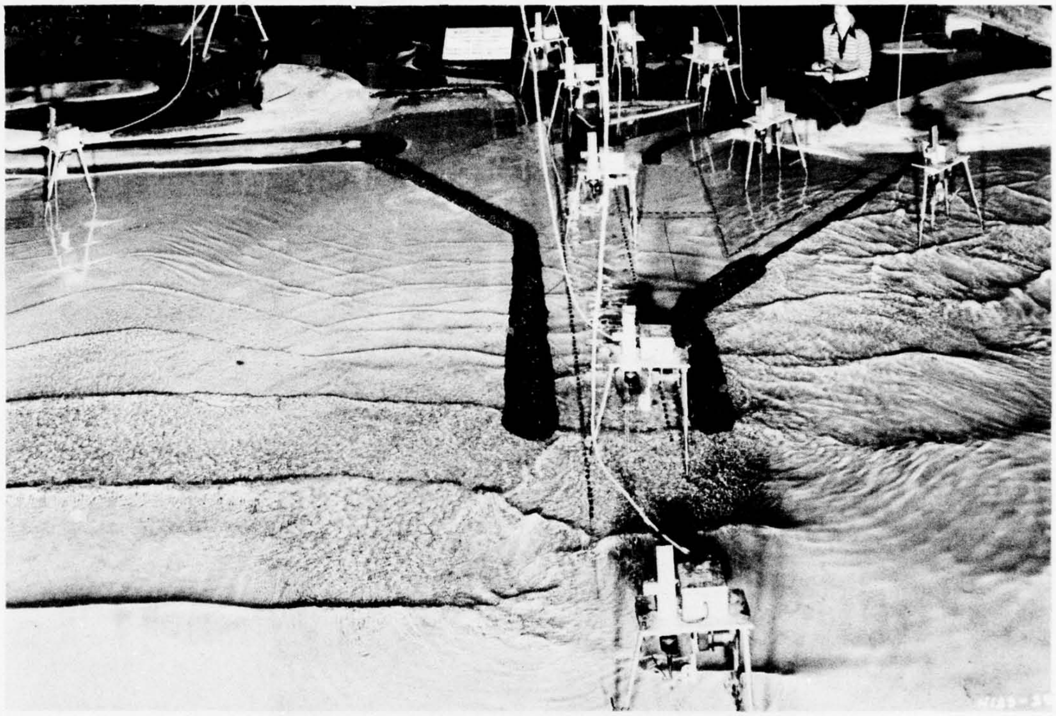

Figure 12. Wave gages

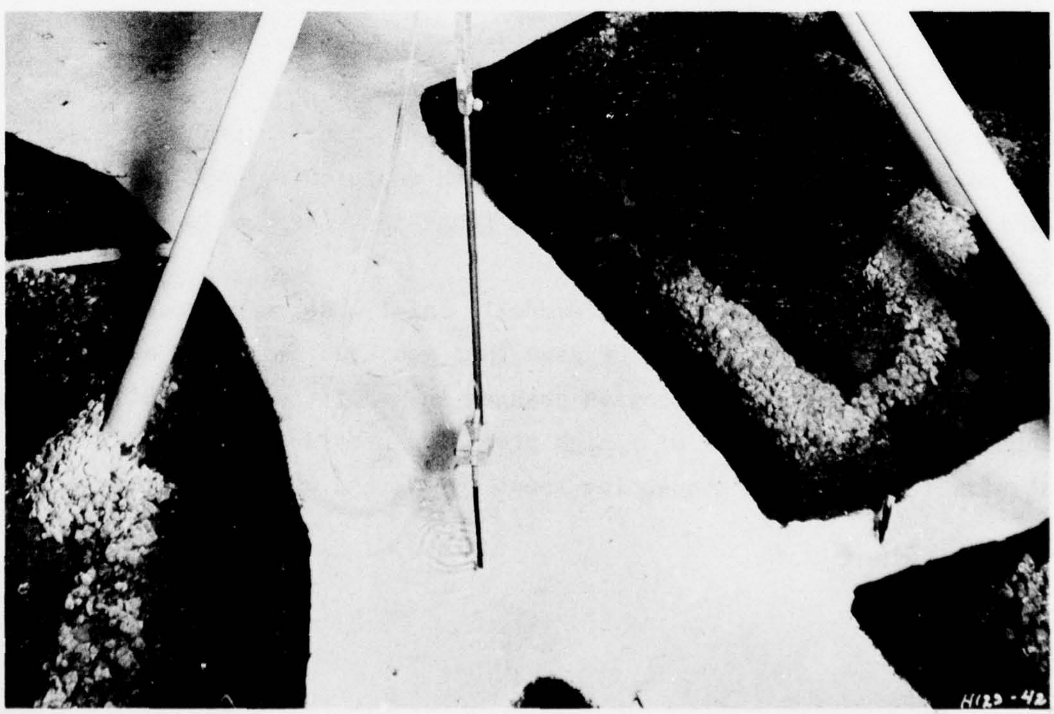

Figure 13. Tide gage

PART IV: MODEL VERIFICATION

25. Upon completion of construction of the Murrells Inlet hydraulic model, the ADACS described previously had just been installed and became operational for models of harbors and tidal inlets. Availability of this new capability for acquisition and analysis of large quantities of model data led to the plan to attempt verification of Murrells Inlet model by using the M_2 tidal constituent.[4]

Procedure

26. In the past, verification of distorted-scale tidal inlet and estuary models consisted of first matching model and prototype tide curves at key locations within the estuary and on the open coast. This matching process was performed either by visual means or by a least-squares analysis of a discrete (but relatively small) number of points during a tidal cycle. Adjustments in model roughness were made primarily on the basis of the tidal amplitude comparison but also considering the phase if there was an obvious disparity between model and prototype curves. It was difficult to visually detect relatively small phase differences if the relative phase of the tidal constituents was not known for either the model or prototype curves. Subsequent to verification of the tidal elevations, a tidal velocity verification was conducted during which additional model friction adjustments were made.

27. Upon considering the capabilities of the newly operational ADACS and the availability of prototype data on the amplitude and phase of the tidal constituents, it became apparent that there was an opportunity to improve the model verification procedure with no increase in model testing cost (and potentially a decrease in future model testing costs).

28. The desired verification procedure can be summarized as follows:

- a. Adjust the tide generator to reproduce M_2, M_4, M_6, and M_8 at an open-coast gage.

b. For both model and prototype, calculate the amplitude and phase of M_2 at each gage in the inlet and estuary and tabulate the phases relative to the open-coast gage and relative to adjacent gages in the estuary and compare these calculations with one another. Also, calculate the mean tidal levels at all model gages and compare with those for the prototype.

c. Readjust model roughness (preferably between two gages only), conduct another test, and again calculate the amplitude and relative phases at all gages for the M_2 constituent.

d. Repeat step c until a satisfactory verification has been achieved.

29. The desired procedure described above was not followed precisely due to various reasons such as problems with the tide controller and time constraints on the project schedule. Actually, the tide generator was adjusted to reproduce the M_2 component at the open-ocean gage; however, the energy in M_4, M_6, and M_8 components was not reproduced for this gage. Consequently, the energy in the overtides was not precisely what it should be; however, it was the correct order of magnitude since the M_2 component accounts for 90 percent of the amplitude. The remainder of the procedure described above was followed. The parameters used to achieve the horizontal distribution of roughness elements were the relative phase of the M_2 tidal constituent and the mean tide level at different locations along a tidal channel relative to some reference location in the channel.

30. Elevation of the prototype tide at a specific location can be represented by

$$h(t) = H_o + \sum_{i=1}^{N} f_i H_i \cos \left[a_i t + (V_o + u)_i - \kappa_i \right] \qquad (1)$$

where

h = tidal height at time t_i

t = time reckoned from some initial epoch

H_o = mean height above reference datum

N = total number of constituents

f_i = factor to reduce mean amplitude to year of prediction

H_i = mean amplitude of i^{th} constituent

a_i = angular speed of i^{th} constituent

$(V_o + u)_i$ = equilibrium argument of i^{th} constituent for $t = 0$

κ_i = local epoch of i^{th} constituent

The harmonic analysis performed by NOS provided H_o , H_i , and κ_i for each tide gage. Other coefficients f_i , a_i , and $(V_o + u)_i$ can be obtained from appropriate tables.[5] The above equation can be re-written in the form

$$h(t) = H_o + \sum_{i=1}^{N} A_i \cos (\omega_i t + \phi_i) \tag{2}$$

where

$A_i = f_i H_i$ = amplitude of i^{th} constituent

ω_i = angular frequency of i^{th} constituent

$\phi_i = (V_o + u)_i - \kappa_i$ = phase of i^{th} constituent

which was used for model control and analyses of the hydraulic model data. A harmonic function composed of the M_2 component was used as the initial command signal to the model tide generator, and tidal heights were recorded simultaneously at all model tide gages. The model tidal elevation can be represented as

$$h_M(t) = \hat{h}_M(t) + \varepsilon(t) \equiv a_o + \sum_{i=1}^{N} \left[a_i \cos (\omega_i t) + b_i \sin (\omega_i t) \right] + \varepsilon(t) \tag{3}$$

where

a_o, a_i, and b_i = coefficients

$\hat{h}_M(t)$ = the calculated tidal elevation represented by a harmonic series of known frequencies

$\varepsilon(t)$ = noise

Since the noise level is unknown, the method of least squares is used to solve for the unknown coefficients (amplitudes and phases) for the M_2, M_4, M_6, and M_8 tidal constituents by minimizing the variance of the sum of the squared difference between the measured model tidal elevation and the assumed form for the model tidal elevation.

31. Therefore the harmonic coefficients for the model tidal height at each tide gage can be used to calculate the phases of the tidal constituents at each gage relative to tidal gage 8 on the open ocean and the differences in the model and prototype relative phases can be determined.

32. The above procedure should, in principle, lead to an excellent tidal verification. It was decided to attempt to verify the tidal amplitudes within ± 0.1 ft and the phase of M_2 within ± 1.0 deg.

33. It appeared that the primary problem which might not be solved by the M_2 verification procedure enumerated above would be the situation in where a spring tide caused a considerable amount of flow to occur over relatively flat marsh areas which might have little or no flow over them for the M_2 constituent of smaller amplitude. If such were the case, there would have been a lack of adjustment of model roughness in these areas. A minor problem somewhat analogous also could occur for a neap tide if there were too much roughness in relatively shallow channels. However, for tidal regimes dominated by M_2 variance, this procedure with emphasis placed on mean tide level verification (the average tidal elevation) as well as the M_2 constituent throughout the inlet should minimize this problem.

Tidal Verification for the M_2 Constituent

34. Since this was the first time such a verification procedure was attempted, it required more tests than were originally contemplated to verify the M_2 constituent. However, the total time for verification was normal or less than that for similar models using the usual procedure. A total of 73 test runs were made leading up to the verified condition. This number included all runs, some of which were made to

determine optimum sump water level and to repair the model tide generator which malfunctioned twice during the process. When testing was ongoing, two tests were conducted per day.

35. Tables 2-5 show some results of the M_2 constituent verification procedure after runs 1, 36, and 73. Run 1 represents the first test, run 36 an intermediate test, and run 73 the verified condition.

36. For run 1, Table 2 shows all model tidal amplitudes were too high (most by about 0.3 ft) and Table 3 indicates that the tide reached all estuary gages too fast relative to gage 8 (the phase differences ranged from about 6 to 18 deg). Table 4 shows there was about the correct amount of roughness between gages 4 and 7; however, there was too much roughness (or flow restriction) between gages 6 and 7, too little roughness elsewhere. Therefore more roughness should be added between gages 1 and 2 and a little more was needed between gages 2 and 3. Actually, an error in molding the channel between gages 6 and 7 did not allow enough flow through the channel but was corrected. Table 5 illustrates that the mean tide level was too high (generally by 0.1-0.3 ft) everywhere except at gage 3.

37. For run 36, Table 2 shows that all tidal amplitudes were still too high but within 0.1 ft of the prototype, and Table 3 indicates that the tide still reached all gages except gage 4 too fast relative to gage 8. However, the largest phase difference had been reduced to 3 deg. Table 4 shows more roughness was needed between all gages, but the most was needed between gages 1 and 2 and between gages 4 and 6. Table 5 illustrates that the mean tide level was too low at all model gages and that the magnitudes of the error (0.1-0.4 ft) were generally larger than those observed in run 1.

38. For run 73, the verified condition, Table 2 shows that all model tidal amplitudes were less than those of the prototype but by only a few hundredths of a foot (the largest difference was 0.07 ft). Table 3 indicates that about half of the phase differences were positive and half were negative (relative to gage 8), with the largest being 1 deg (about 2.1 min). Table 4 shows that the largest phase difference between interior gages was 1.17 deg (about 2.4 min) and that

was between gages 5 and 6. Table 5 illustrates that the mean model tide level was higher than that of the prototype at about half the gages and lower at the other half. The largest difference in the mean tide level was about 0.09 ft at gage 7.

39. Figures 14 and 15 illustrate model (runs 1 and 73) and prototype M_2 tide curves for gage 8 and gage 2, respectively. Plates 3-6 show the final model verification tidal curves compared with the prototype curves.

40. To summarize the M_2 constituent tidal verification, the M_2 tidal amplitudes were reproduced to within ± 0.1 ft, the mean tide level to within ± 0.1 ft, and the phase of the M_2 constituent to within 1 deg relative to the phase at the open-ocean gage. This is considered to be an excellent M_2 constituent verification.

Velocity Verification

41. Due to the excellent accuracy of the verification of the M_2 tide elevations, it was believed that the head differences between gages would accurately reproduce velocities. Thus it only remained to adjust the roughness laterally in the bay channels to obtain a good velocity verification. The prototype tide range on the day of velocity observations was 6.0 ft (4.8 ft of which was due to the M_2 constituent, i.e. 80 percent of the total tide range). Thus the model velocities for the M_2 constituent should be slightly less (about 9 percent) than the prototype measurements for the total tide range of 6.0 ft. Figure 16 illustrates a sample of the velocity verification. A complete set of velocity verification data is shown in Plates 7-17.

Base Data

42. Following the verification of tidal elevations and velocities, surface current photographs at hourly intervals throughout a tidal cycle were taken of the natural inlet conditions for the mean tide (Photos 1-13, designated base photographs). Also the verified model

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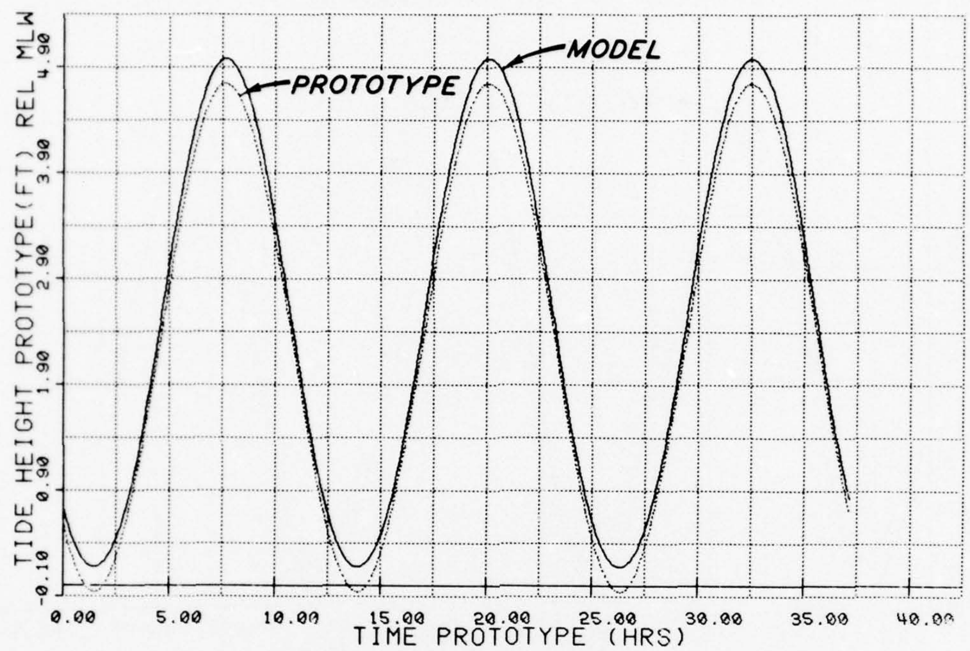

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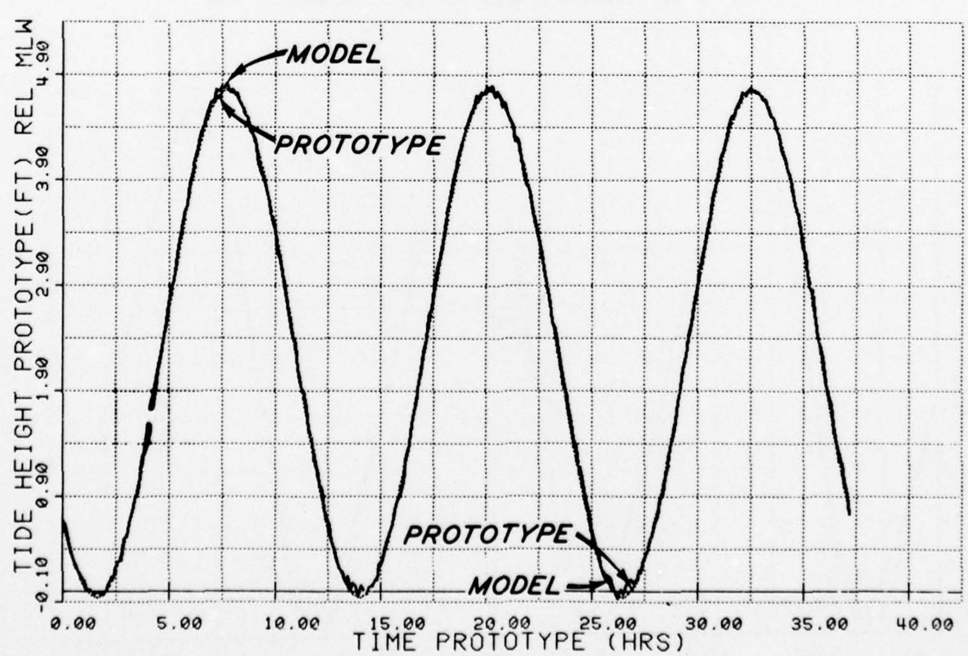
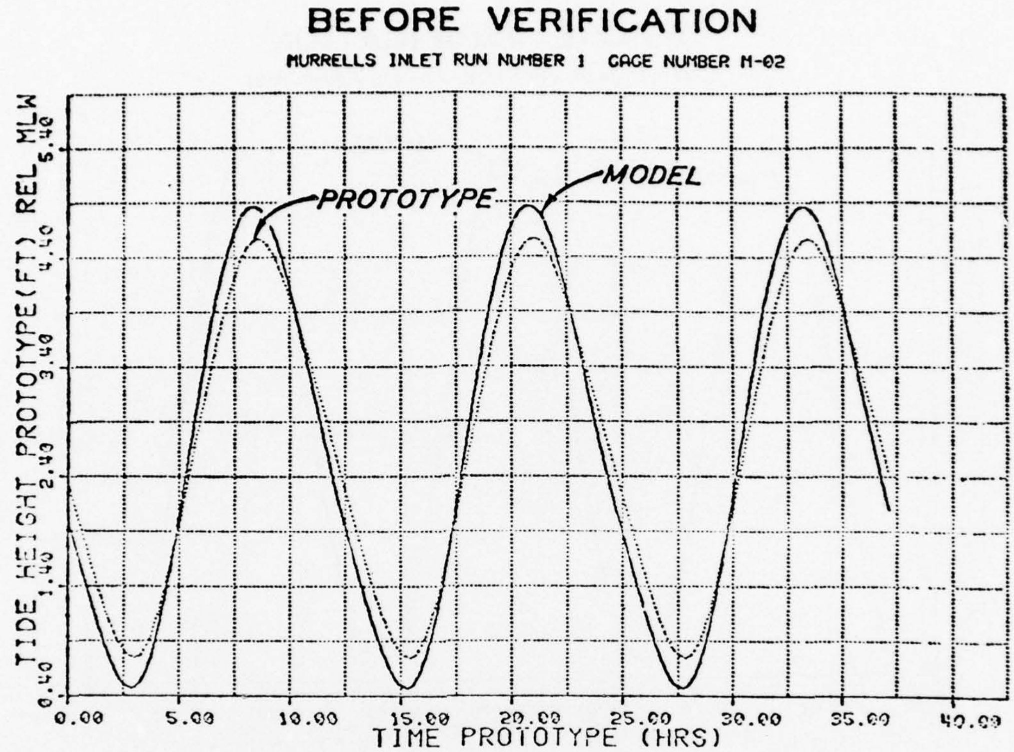


Figure 14. M_2 tidal elevation at gage 8, near mouth of Murrells Inlet



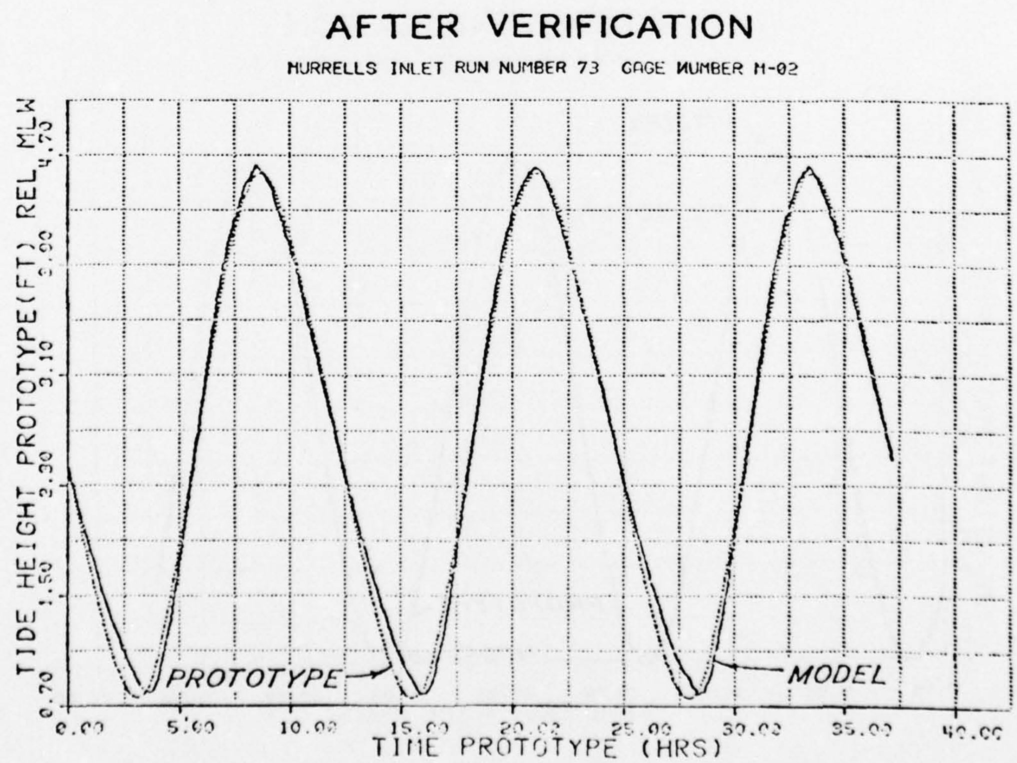


Figure 15. M_2 tidal elevation at gage 2, in back reach of estuary

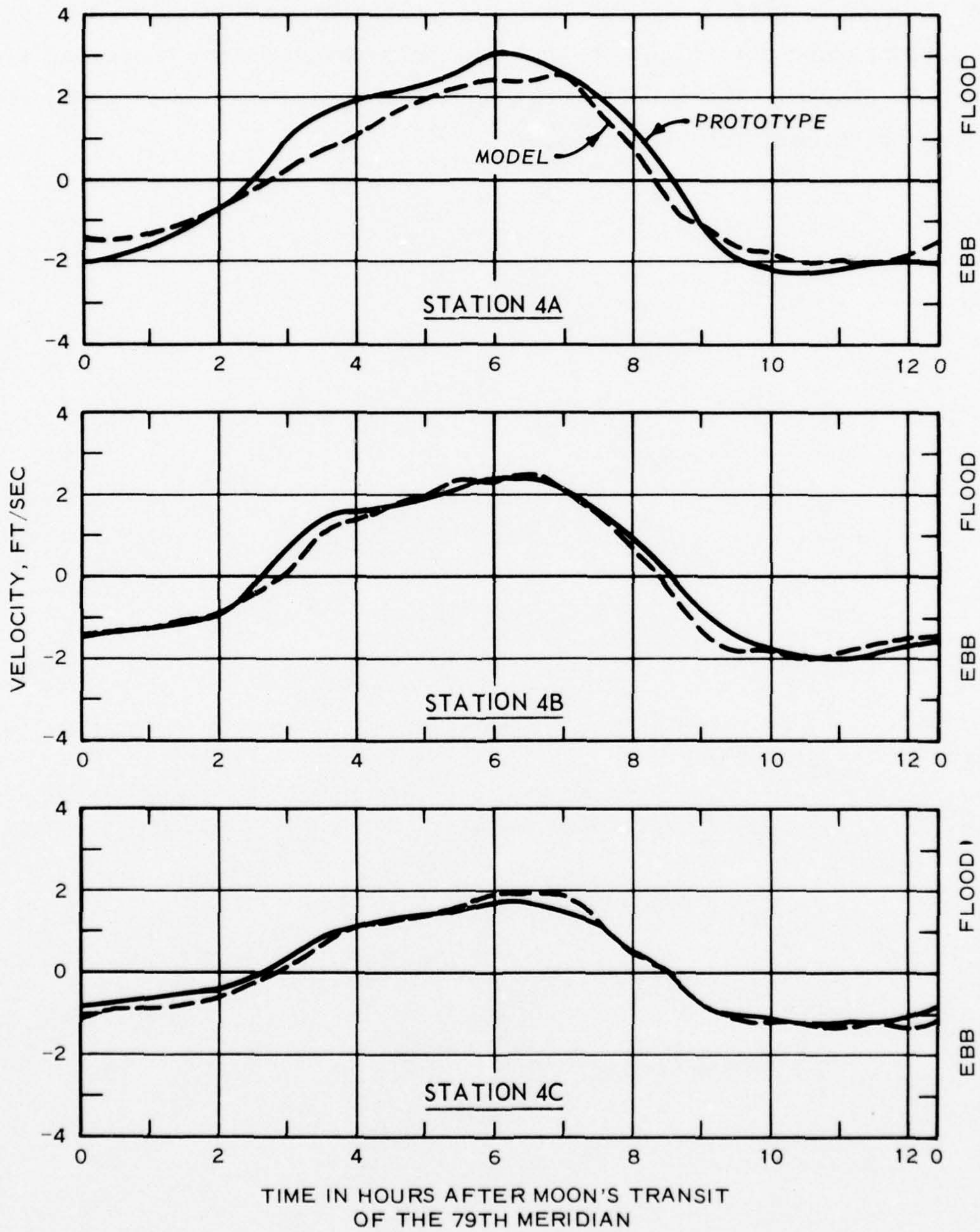


Figure 16. Verification of model velocities, middepth

tidal elevations and velocities were designated as base data with which data from various plans could be compared in order to evaluate changes due to a given plan. In each test of a plan the same model operating conditions were maintained so that the only changes were those due to the plan itself. The 4.8-ft range M_2 tidal constituent was reproduced at gage 8 (ocean) for each test.

PART V: PRELIMINARY TESTS (PLANS 1-7)

43. The testing program generally followed this sequence:

a. Preliminary tests - An examination was made of a variety of plans by the use of surface current photographs and tidal elevation data.

b. Detailed tests - A further examination of the best plans selected from the preliminary tests was made by obtaining detailed point velocity and wave measurements.

c. Final tests - Further detailed refinements were made and tested for the best plan selected from the detailed tests. All types of data were gathered as needed.

44. A series of seven jetty system designs was submitted to the SAC for review. In developing these plans, consideration was given to the natural channel alignment and wave direction information.[2] Channel dimensions, jetty spacing, and low weir dimensions for each plan were similar to the plan described in the SAC Survey Report.[2] From the seven plans, five (plans 1, 2, 4, 6, and 7) were selected for preliminary model testing. A variation of plan 1, identified as 1A, was added to the preliminary testing after plan 1 was examined in the model. Thus, the six plans shown in Figures 17-19 were subjected to preliminary testing.

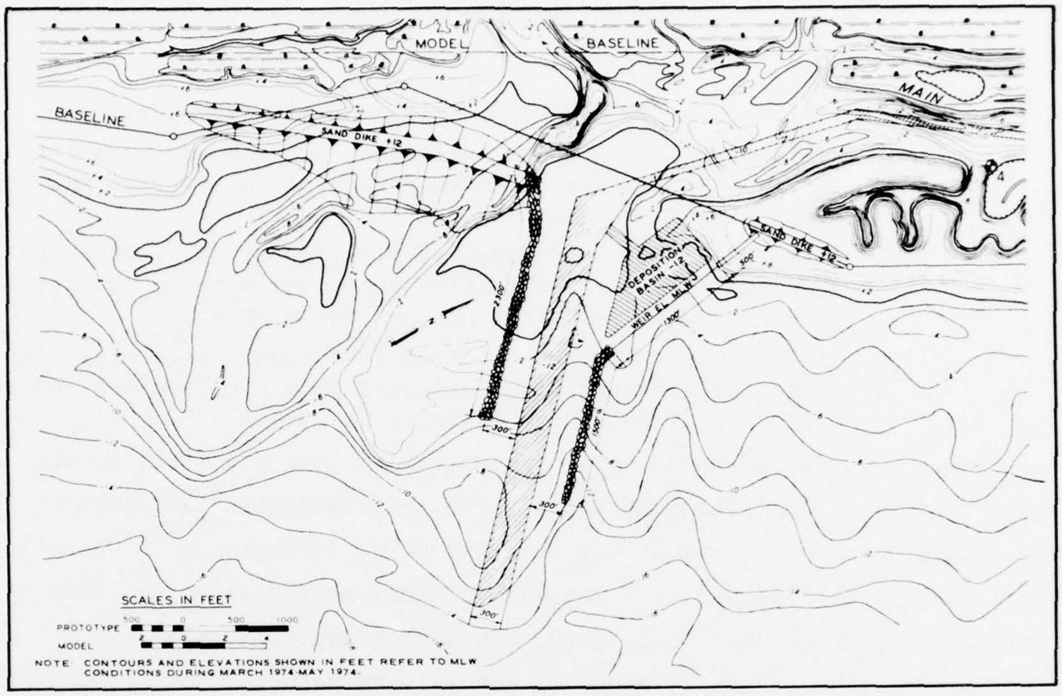
45. Tidal elevation data and surface current photographs were collected for the six plans.

Surface Current Photographs

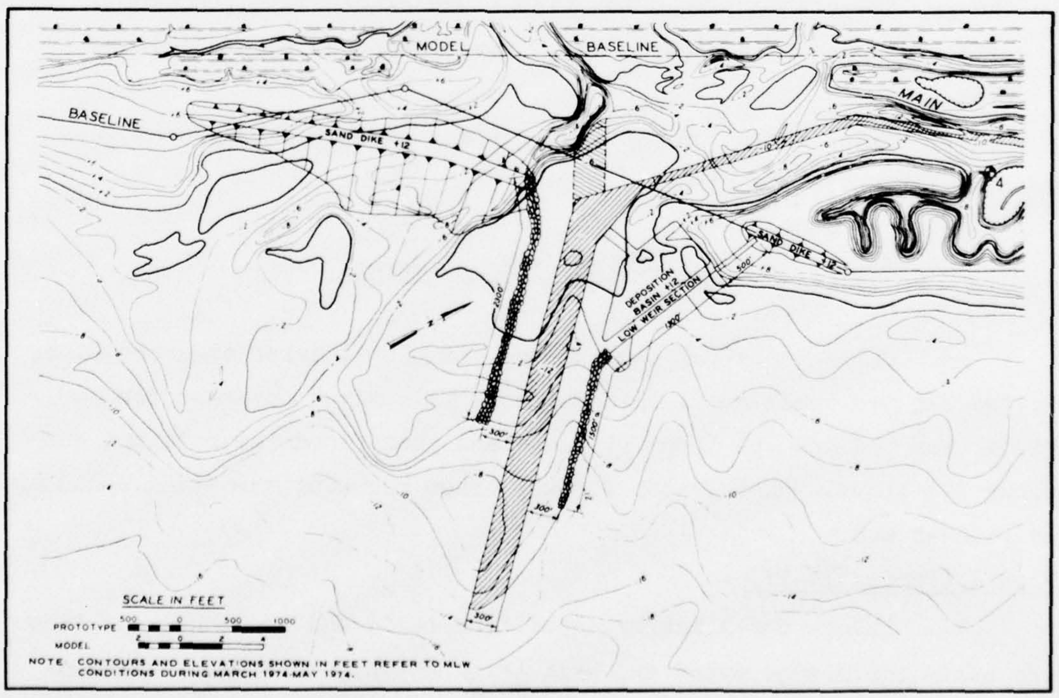
46. Photographs for each of the six plans, taken at hours 4, 7, 9, and 12, are included in this report. This gives coverage for early flood (hour 4) and ebb (hour 9) flows and peak flood (hour 7) and ebb (hour 12) flows. Photographs for the other hours of the tidal cycle are on file at WES.

Plan 1 (Photos 14-17)

47. Except for a larger deposition basin and a channel cut into the basin for dredge entry and exit (Figure 17a), this was the recommended plan from the SAC Survey Report.[2] This plan constricted flow to



a. Plan 1



b. Plan 1A

Figure 17. Plans 1 and 1A

and from Oaks Creek except for that which passed over the marsh or overbank area during the high-water portion of the tidal cycle. During both maximum flood and ebb flows (Photos 15 and 17, respectively), surface currents indicated a tendency to swing toward the inner end of the south jetty and the sand dike and away from the dredged channel. This could eventually cause a migration of the channel and a resultant scour.

Plan 1A (Photos 18-21)

48. Plan 1 was modified by the addition of a 300-ft-wide by 6-ft-deep auxiliary channel between the entrance channel and Oaks Creek (Figure 17b). This was done in an effort to confine maximum flow currents within this channel and away from the sand dike and the inner end of the south jetty. Maximum flood and ebb surface current flows (Photos 19 and 21) indicated good results from plan 1A. A minimum depth of 6 ft was recommended to ensure the operation of a dredge.[6]

Plan 2 (Photos 22-25)

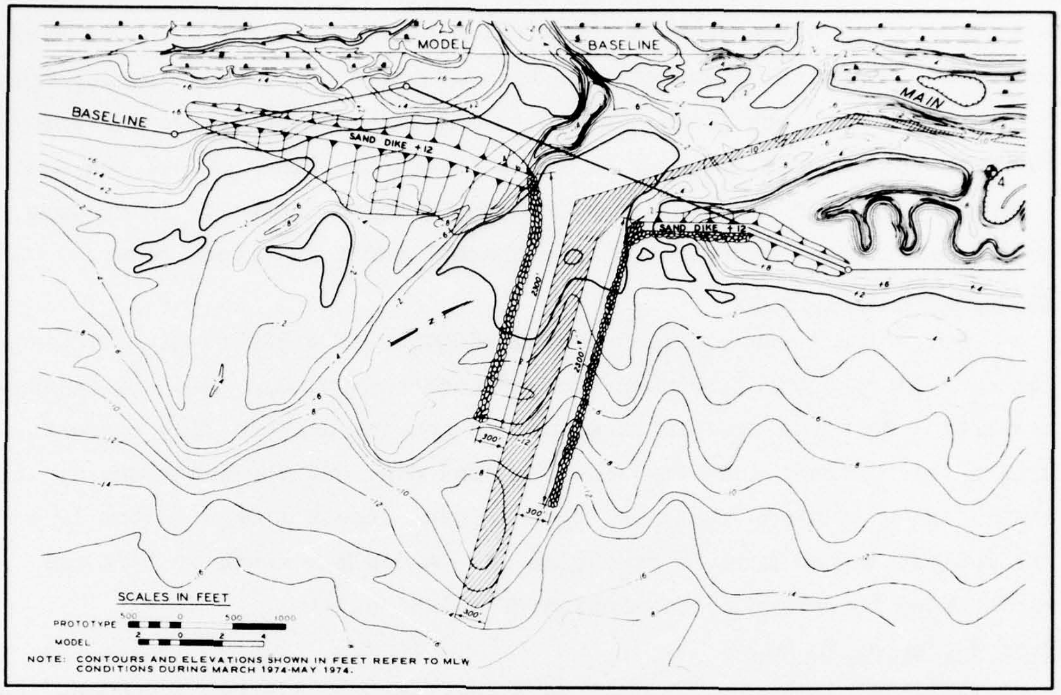
49. For this plan the low weir section of the north jetty and the deposition basin were eliminated (Figure 18a). Maximum ebb velocities (Photo 25) indicated a strong impingement of flow to the south side of the channel (worse than that in plan 1) which would indicate a migration of the channel toward the south jetty. This migration would also undoubtedly influence the flow to and from Oaks Creek.

Plan 4 (Photos 26-29)

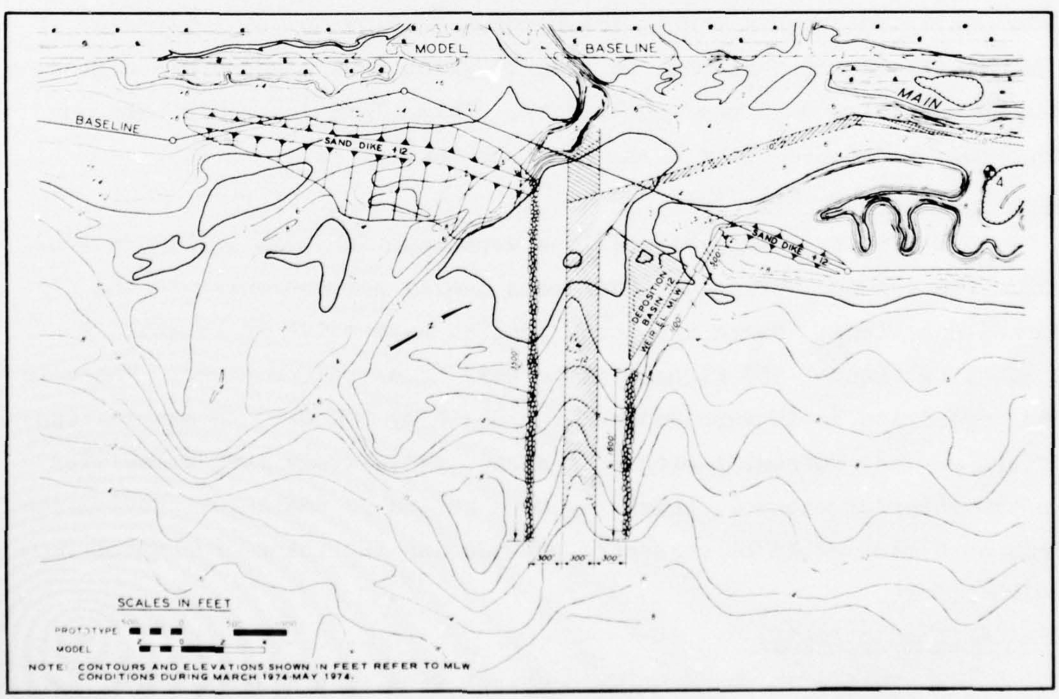
50. The following alterations were made for plan 4 (Figure 18b). The direction of jetties was made more nearly perpendicular to the normal coastline. North and south jetties were equal in length. A connecting channel 300 ft by 6 ft to Oaks Creek was provided. The weir and deposition basin were reduced in length by 200 ft. An examination of the surface current photographs showed excessively fast velocities in the interior channel, which may be a hazard to small-boat navigation. This condition could be corrected by widening the interior channel from 90 to 150 ft.

Plan 6 (Photos 30-33)

51. This plan was nearly identical with plan 4 except that the low weir section and deposition basin were eliminated (Figure 19a) and

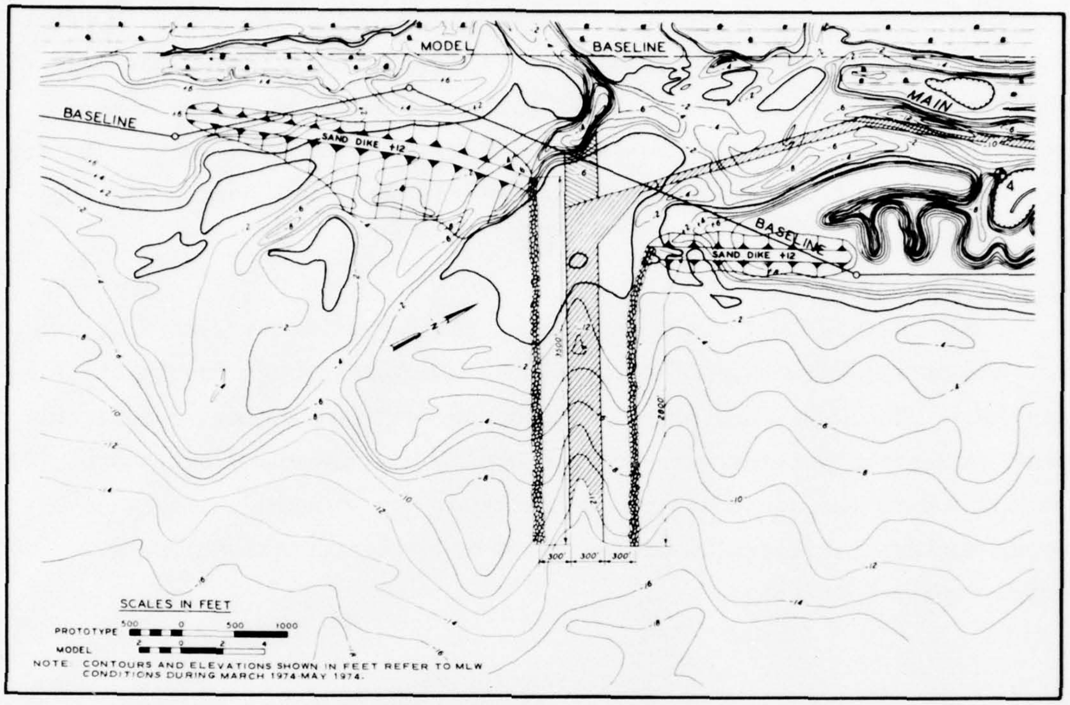


a. Plan 2

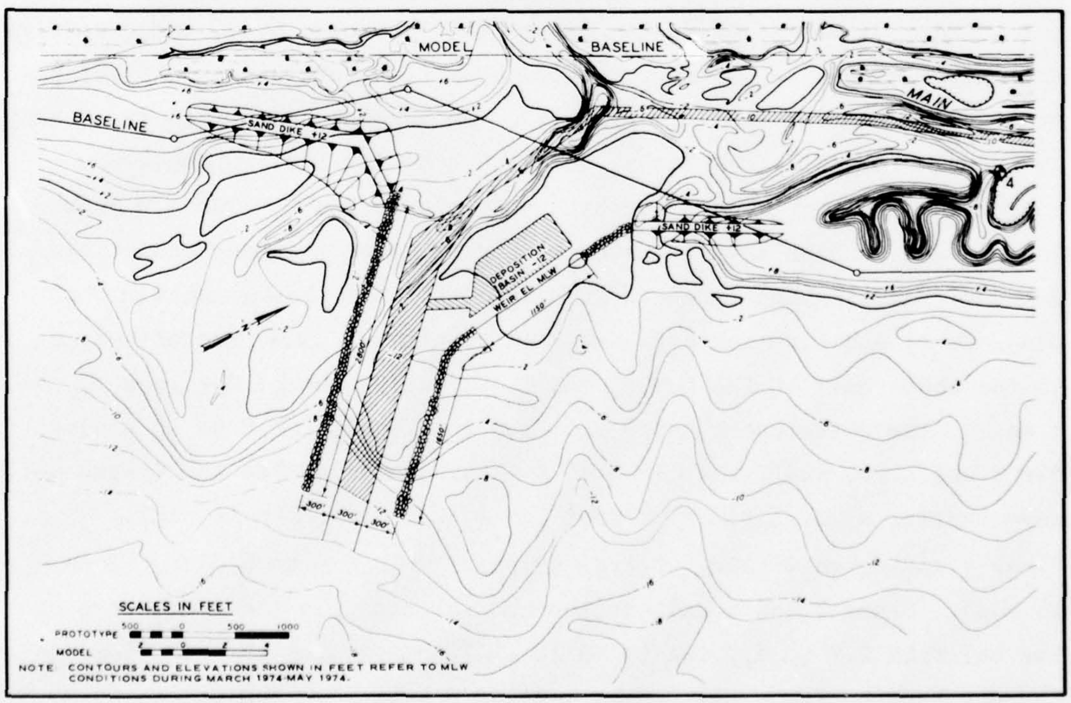


b. Plan 4

Figure 18. Plans 2 and 4



a. Plan 6



b. Plan 7

Figure 19. Plans 6 and 7

the inner end of the north jetty was realigned. This slightly increased velocities in the entrance channel as flow normally crossing the weir for approximately 7 hr of the tidal cycle was diverted to the channel between the jetties. This configuration would probably result in better self-maintenance of the entrance channel but would not handle littoral drift problems.

Plan 7 (Photos 34-37)

52. Jetties and entrance channel were moved about 1200 ft south to take better advantage of the existing channel through the inlet (Figure 19b). The realigned plan included the weir and basin. Undesirably fast current velocities were noticed during maximum ebb flow (Photo 37) very close to the south jetty. Degradation and widening, likely to occur during stabilization of the inlet after construction, could improve this condition.

Tidal Elevations

53. Tidal data (station locations shown in Plate 1) taken for the preliminary plans are shown in Plates 18-57. Tables 6, 7, and 8 compare amplitudes (one half of tidal range), mean tide levels, and phases, respectively, for the preliminary tests. In general, each plan resulted in a larger bay tidal amplitude (about 0.1 to 0.4 ft). Plans 4 and 6 increased tidal amplitude more than plans 1, 2, and 7. Table 9 shows the changes in high and low water with respect to the base conditions. Table 8 indicates that phase differences from the base condition for plans 1, 2, and 7 follow a trend of later arrival times for all gages in the south half of the bay (gages 1, 2, and 3) except for gage 1, plan 7. The differences range from 0.8 to 8.9 deg (or 2 to 18 min). For plans 1, 2, and 7 the gages in the north side of the bay (gages 4-7) have earlier arrival times of from 1.6 to 6.6 deg (3 to 14 min). Plans 4 and 6 had earlier arrival times of from 1.6 to 6.6 deg (3 to 14 min). Plans 4 and 6 had earlier arrival times in the south part of the bay from 2.7 to 8.7 deg (5 to 18 min) and earlier arrival times in the north part of the bay (gages 4-7) of 9.4 to 13.4 deg (19 to 28 min).

High water was affected very little, with maximum variations from the base no greater than 0.1 ft for all the bay gages. Low water was lower at every gage for each plan from 0.1 to 0.75 ft. The greatest changes in low water were at gages 4 and 6 for each plan, varying from 0.4 to 0.75 ft. This was due to their location near the dredged bay channel which permitted more efficient ebb flow. Plans 4 and 6 caused the greatest decrease in low water throughout the bay of 0.75 ft. As shown in Table 7, mean tide levels were reduced the greatest amount at gages 4 and 6 for all the plans tested. Plans 4 and 6 had the greatest reduction in mean tide level, about 0.3 ft. Tidal data for plan 1A were not collected but should have been similar to plan 1.

54. Plans 1A (to be modified) and 7 (to be modified) were selected for further testing because they had the least effect on bay tidal elevations and both incorporated a weir into the upcoast jetty.

PART VI: DETAILED TESTS (PLANS 1B/1C AND 7A/7B)

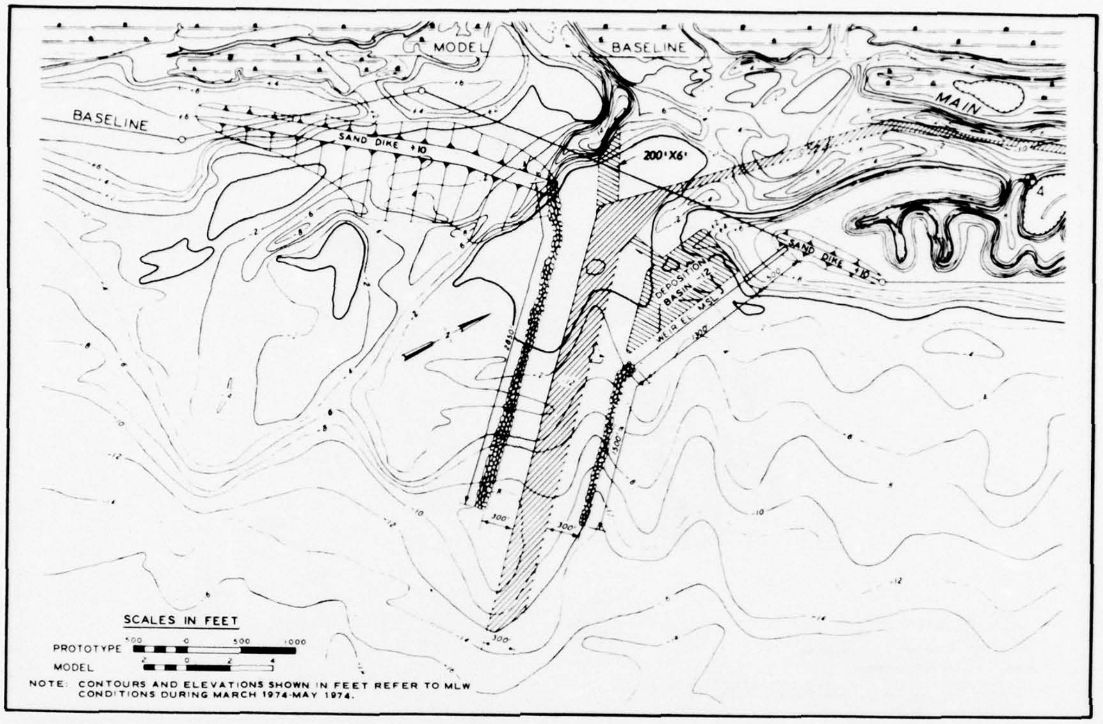
55. Variants of plans 1A and 7 were selected for more detailed tests based on the results of the preliminary tests. The actual variations that were finally tested in this phase of the study were identified as plans 1B, 1C, 7A, and 7B. These plans are shown in Figures 20 and 21.

56. Plan 1B incorporated changes in the auxiliary channel and the length of the south jetty (Figure 20a). The auxiliary channel width of 300 ft used in plan 1A was reduced to 200 ft for plan 1B. The south jetty was extended oceanward equivalent to the north jetty in order to prevent the ebb flow crosscurrent pattern at the jetty tips which occurs when jetties are not of equivalent lengths at the oceanward end (Photo 19, for example). Plan 1C evolved after detailed velocity tests of plan 1B indicated high velocities in the auxiliary channel, and the auxiliary channel was returned to a width of 300 ft (Figure 20b). The bottom elevation of the auxiliary channel was -6.0 ft mlw in each case.

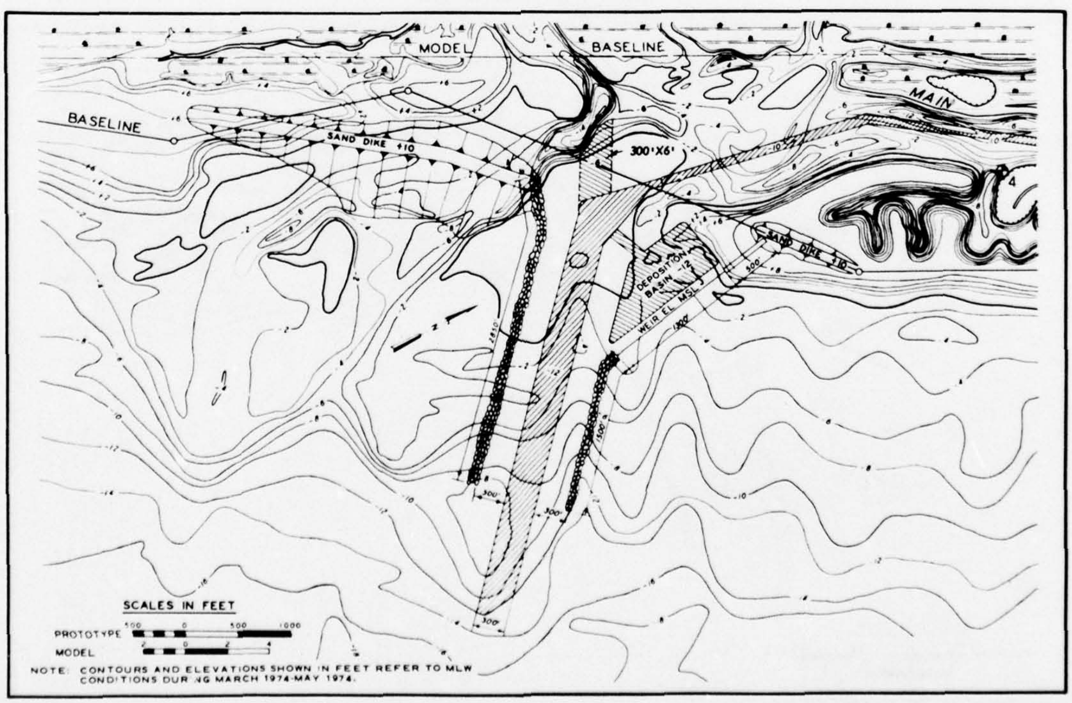
57. Plan 7 was altered for the detailed tests by the addition of an auxiliary channel 200 ft wide for plan 7A (Figure 21a) and 300 ft wide for plan 7B (Figure 21b). All other elements in the plan 7 configuration remained the same as in the preliminary tests.

58. After restoring the model to the base condition bathymetry at the conclusion of the preliminary plan tests, it was found that reproduction of prototype hydraulic conditions was not satisfactorily achieved. This was primarily due to difficulty in repositioning, with a high degree of accuracy, the blocks of concrete that had been removed to represent the proposed dredged channels. Subsequently, a reverification of tidal heights of high quality was achieved and is called base II.

59. A total of 19 wave gages were installed in locations (Figures 22 and 23) to coincide with the proposed channels in the two plans selected for intensive testing (plans 1B and 7A). Wave base tests were timed to coincide with extreme flow conditions (low-water slack, maximum flood, high-water slack, and maximum ebb) in the inlet throat by

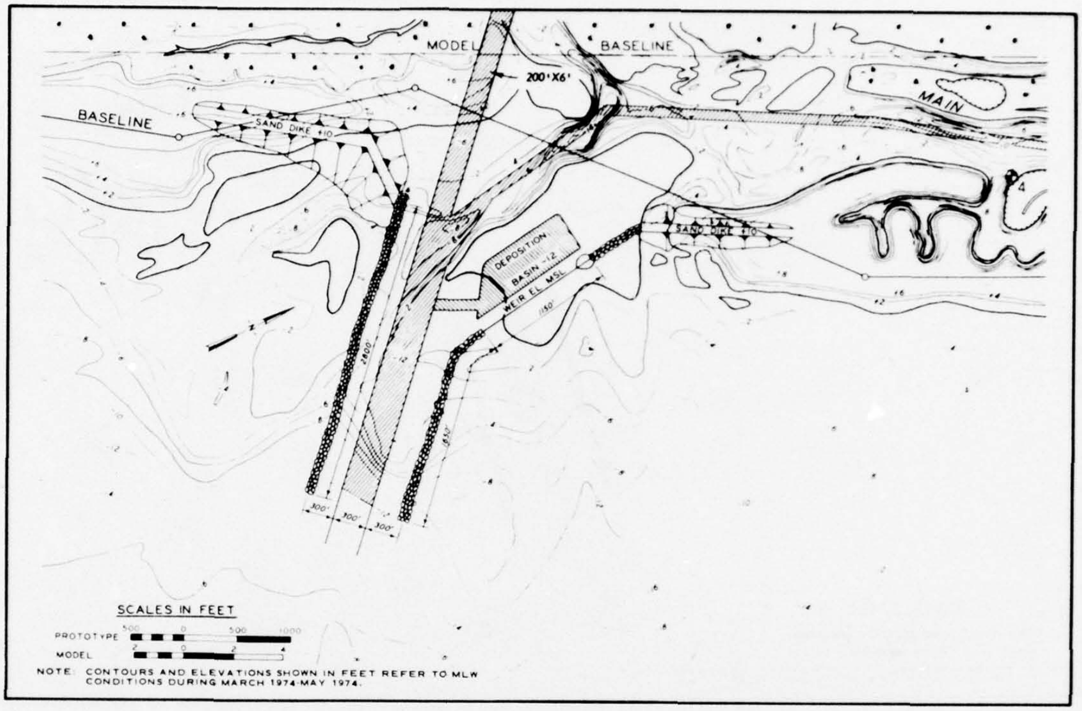


a. Plan 1B

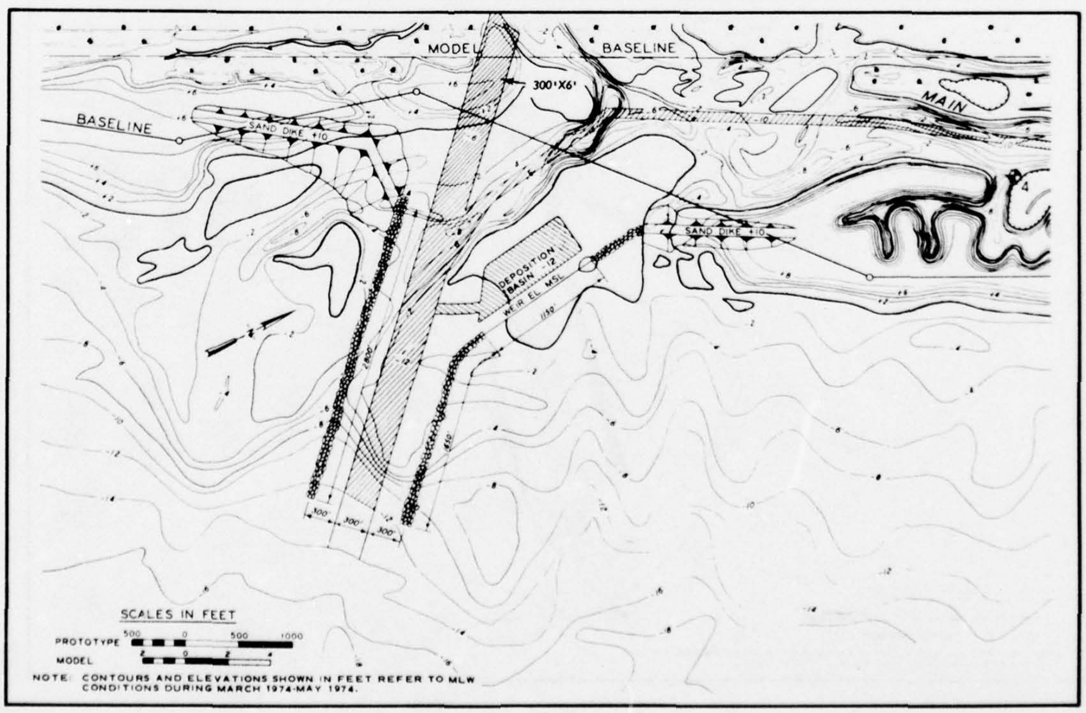


b. Plan 1C

Figure 20. Plans 1B and 1C



a. Plan 7A



b. Plan 7B

Figure 21. Plans 7A and 7B

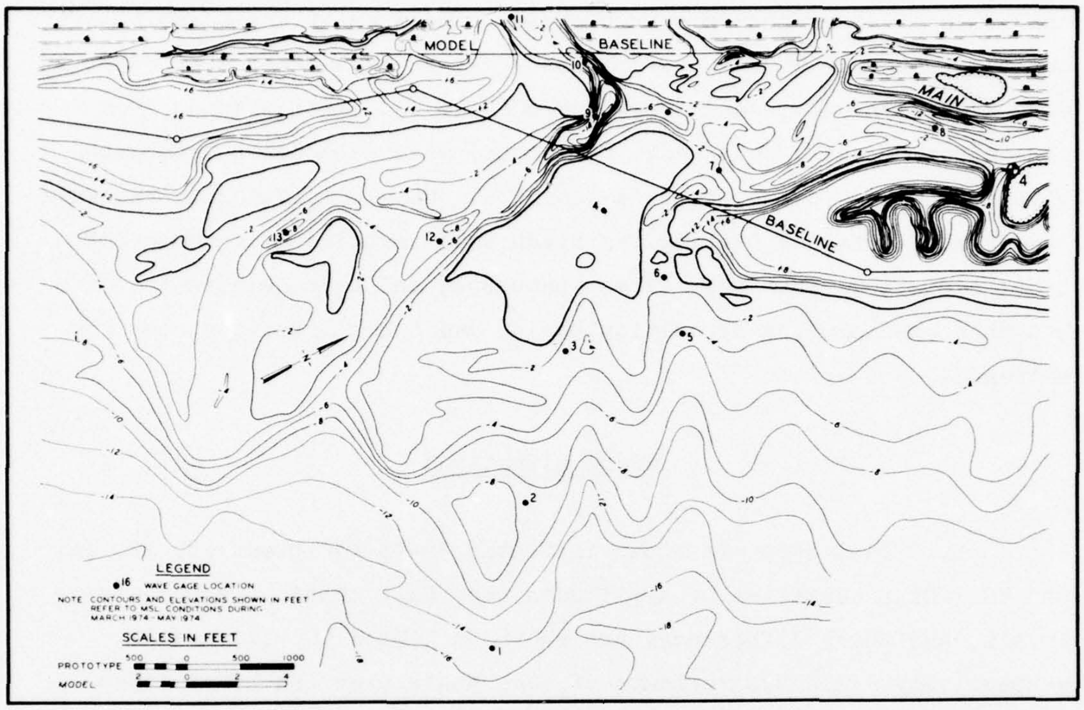


Figure 22. Wave gage locations, base conditions, plan 1

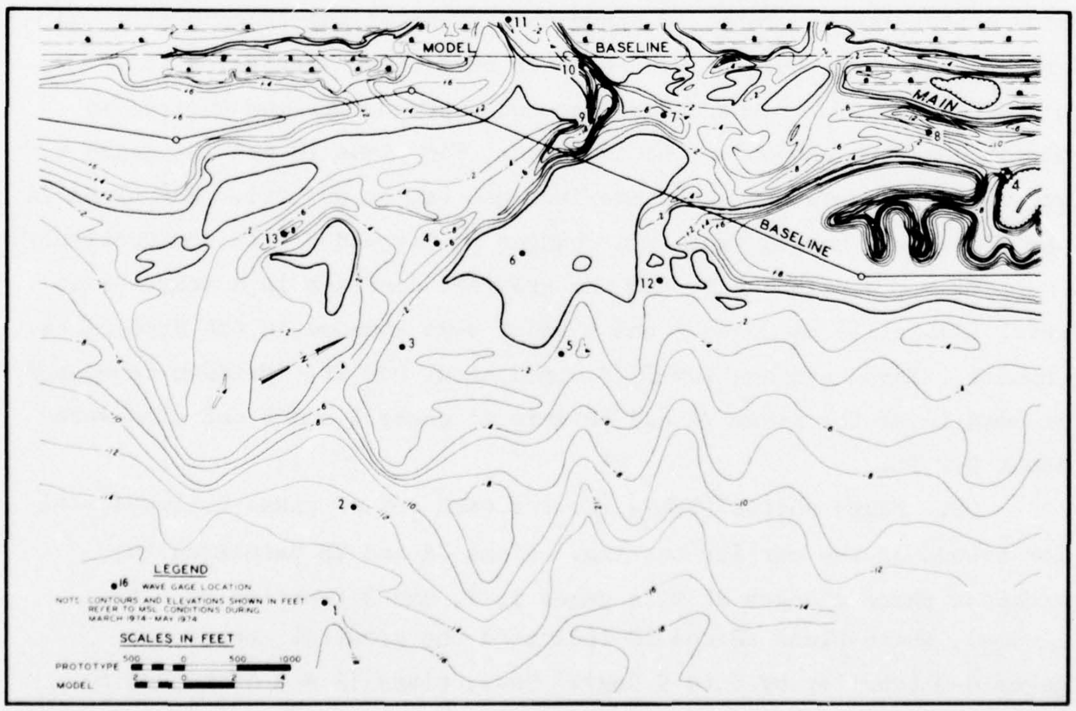


Figure 23. Wave gage locations, base conditions, plan 7

use of an electromagnetic current meter. Because of the scarcity of quality prototype wave data for this area, 12 test waves (representing deepwater waves of 5- and 8-sec periods, 3- and 5-ft heights, from directions of east, southeast, and south) were selected to evaluate wave conditions in the proposed channels. Upon completion of the wave base tests, detailed testing was begun that included measurement of tidal elevations, surface current patterns, and wave heights in the entrance channel, the deposition basin, and other locations near the entrance.

Tidal Elevations

60. Tidal data are shown in Plates 58-73 for plans 1B, 1C, 7A, and 7B. Data summaries of amplitudes (one half of tidal range), mean levels, and phase differences are shown in Tables 10, 11, and 12, respectively. The two variants of each basic plan can be discussed together for most of the tidal analysis since the widening of the auxiliary channel had limited effect on the tidal data in each case of plan 1 and plan 7. Table 10 shows that plans 7A and 7B generally had greater increases (0.2 to 0.4 ft) over base tidal amplitudes than plans 1B and 1C over the entire lagoon; however, maximum changes in amplitudes were close for the two sets. For plans 1B and 1C, gages 4 and 6 had the greatest amplitude increase (about 0.3 ft). For plans 7A and 7B, gage 3 showed amplitude changes of 0.4 and 0.5 ft, respectively.

61. Plans 1B and 1C had the greatest decrease in average tide level (Table 11) at gages 4 and 6 which were located in the dredged bay channel. These average levels dropped about 0.2 ft. Maximum decreases in mean level for plans 7A and 7B were at gages 3 and 4 and also were about 0.2 ft.

62. Phase shifts (Table 12) for each set of plans followed similar trends of the earlier testing. Plans 7A and 7B permitted the greatest phase changes at tide gages 1, 2, and 3 (earlier by 5 to 11 deg), while plans 1B and 1C indicated the greatest changes at gages 4-6 (earlier by 5 to 9 deg). Thus, plans 7A and 7B tended to

permit a quicker filling of the southern portion of the lagoon than the base and plans 1B and 1C, while plans 1B and 1C permitted a faster filling rate of the northern portion of the lagoon when compared with the base and plans 7A and 7B.

63. Changes in high- and low-water elevations compared with the base are shown in Table 13. Plans 1A and 1B caused no changes in high water in the lagoon; while low water was lowered between 0.1 to 0.2 ft at all gages except gages 4 and 6, which are located in the dredged bay channel where low water dropped 0.7 ft. Plans 7A and 7B showed small increases in high water (0.1 to 0.2 ft), while low water decreases of 0.6 to 0.7 ft were noted at gages 3, 4, and 6, 0.4 ft at gages 2 and 5, and 0.1 ft at gages 1 and 7.

Tidal Velocities

64. The locations of point velocity measurements in the entrance area are shown in Plates 74-77 for plans 1B, 1C, 7A, and 7B, respectively. Ranges 1 and 2 were replaced by the stations shown in the above-mentioned plates. Ranges 4-6 located on the interior bay channels are shown in Plate 2.

Plans 1B and 1C

65. Velocities between the jetties at sta 7A and 8A were the same for both plans (Plates 78 and 79). Maximum surface currents were from 1.5 to 1.8 fps on flood flow and 2.5 fps on the ebb flow. Maximum bottom velocities were 1.4 to 1.5 fps on flood flow and 1.8 to 2.0 fps during ebb flow. Flow predominance calculations, in which the area under the ebb velocity-time curve is divided by the area under both the ebb and flood velocity-time curves for a given station and depth, indicated that there was an ebb predominance at sta 7A and 8A. For surface velocities at sta 7A and 8A and for plans 1B and 1C, ebb predominance was 61, 59, 58, and 60 percent, respectively; for bottom velocities, ebb predominance was 55, 57, 56, and 56 percent, respectively. Thus it is seen that there was a net oceanward flow due to the splitting of flood flow between the channel and that coming over the weir section while most

of the ebb flow returned oceanward in the channel between the jetties. This might aid in keeping sediment flushed oceanward.

66. Maximum ebb and flood velocities at sta 9A and 9B (main channel, Plates 80 and 81) were about 0.5 fps higher than those at sta 7A and 8A (farther seaward in the main channel). As expected, ebb and flood velocities at sta 10A were lower for plan 1C because of the enlarged channel cross section. Sta 10B (Plate 82) taken for only the plan 1C condition, had peak ebb velocities of 3.4 fps and flood velocities up to 2.4 fps at middepth.

67. Maximum ebb and flood velocities at sta 11A and 12A (Plates 83 and 84) were somewhat greater for plan 1B than those for plan 1C (by about 0.2 to 0.8 fps). This resulted from the slight redistribution of flow to and from the back bay area covered by the more constricted auxiliary channel in plan 1B than in plan 1C.

68. Sta 3A, 3B, 3C and 3D (Plates 85 and 86) showed various changes from the base due to the reorientation of flow caused by the jetty and channel systems. For base conditions, sta 3C was located in the main flow channel. Since that was not the case for the plan conditions, both plans caused major velocity reductions at this location. Sta 4A, 4B, and 4C and 5A, 5B, and 5C (Plates 87 and 88) all showed decreases from the base condition for plan 18 (data was not taken at ranges 4-6 for plan 1C) in which case the dredged channel caused a change in local flow conditions. Decreases varied up to 1.5 fps. Sta 6A, 6B, and 6C (Plate 89) showed increases up to 1.0 fps over the base. At range 8 the dredged channel caused a more uniform lateral flow distribution, with the result that flood velocity at sta 5C was essentially unchanged by the plan. The increased ebb duration and increased velocities at range 6 seem to be caused by a general redistribution of flow patterns in back bay areas caused by channel deepening and changes to the bifurcation geometry just inside the entrance.

Plans 7A and 7B

69. Velocity sta 13A and 13B (Plates 90 and 91), 14A and 14B (Plates 92 and 93), and 15A and 15B (Plates 94 and 95) were located in the entrance navigation channel. Peak flood flows for both plans at

these locations were from 1.5 to 2.0 fps at the surface and from 1.0 to 1.5 fps at the bottom. Peak ebb flows for both plans varied between 2.0 to 2.5 fps at the surface stations and peak bottom ebb flows varied from 1.5 to 2.0 fps. Comparison of ebb and flood flows shows that an ebb flow predominance exists in the navigation channel as discussed previously for plans 1B and 1C. Ebb flow predominance values varied from 55 percent to 60 percent for sta 13A and 13B and 14A and 14B. Differences between the plans at these locations indicated slightly higher (0.3 fps) maximum ebb currents at sta 13A, 14A, and 15A for plan 7A. This was probably due to the narrower auxiliary channel which joins with the southern portion of the navigation channel, thus concentrating the flow on this side of the channel while the wide auxiliary channel of plan 7B distributed its flow more uniformly over the entire navigation channel. Surface flood flow at sta 15A and 15B indicated about 0.5 fps higher velocities for plan 7B than for plan 7A. This is probably indicative of a greater flow into the wider auxiliary channel of plan 7B.

70. Sta 16A (Plate 96) had higher velocities for plan 7A than plan 7B since the channel was more constricted. Maximum velocities were 2.5 fps during flood flow and 2.3 fps during ebb. Plan 7B ebb and flood maximum velocities were 1.1 and 1.9 fps, respectively.

71. Maximum ebb and flood velocities at sta 17A (Plate 97) were somewhat greater for plan 7A than those for plan 7B (by about 0.2 to 0.6 fps). This resulted from the slight redistribution of flow to and from the back bay area caused by the more constricted auxiliary channel in plan 7A than in plan 7B. Sta 18A (Plate 98) had almost identical velocities for both plans but lower bottom flood velocities for plan 7A were noted.

72. Range 3 velocities (Plates 99 and 100) which are compared with base data show changes due to reorientation of the flow with the structures in place. At sta 3A, velocities were reduced because the sand dike cut off flow to and from that location via a secondary entrance channel to the ocean. Conversely, velocities at sta 3B were increased because the sand dike diverted flow to and from Main Creek

through the channel in which this station was located. At sta 3C, velocities were increased slightly, apparently because the flow diversion caused by the sand dike more than offset the effect of channel cross-section increase caused by the dredged channel. At sta 3D there was a drastic reduction in the magnitude of the velocities, and flow direction was often reversed from base conditions. The channel in this area was changed by the plans from a major flow channel to a minor connecting link between major channels. As a result, its flow patterns were completely changed.

73. Ranges 4 and 5 (Plates 101 and 102) showed decreases at all stations and depths except ebb surface velocities at sta 5A. Range 6 showed slight changes (Plate 103). Velocities at ranges 4, 5, and 6 were not collected for plan 7B.

Comparisons between plans 1B/1C and 7A/7B

74. Plans 1B/1C averaged slightly higher (0.3 fps) maximum ebb velocities in the region between the jetties (sta 7A, 8A, 13A, 13B, 14A, and 14B) though plans 1B/1C velocities were taken on the channel center line and plans 7A/7B velocities were taken on each side of the channel which might produce the variation in maximums. Comparing data at sta 9A and 9B versus sta 15A and 15B showed that velocities were slightly higher for plans 1B/1C, though the differences were not of such magnitude to favor one plan over the other. A net oceanward flow in the navigation channel existed for each plan as discussed previously. Measurements in the auxiliary channel indicated that plans 7A/7B had significantly lower velocities (about 1.0 fps) in each case of either a 300- or 200-ft-wide auxiliary channel. The same was true at the most downstream stations in the 90-ft-wide section of the main channel (sta 11A and 17A). Velocities at ranges 4, 5, and 6 were very similar for both plans.

Surface Current Photographs

75. To minimize report data, surface current photographs only of

hours 4, 7, 9, and 12 of the tidal cycle are shown. These depict conditions during early ebb flow at hour 9, maximum ebb flow surface conditions at hour 12, early flood flow at hour 4, and maximum flood flow at hour 7.

Plan 1B (Photos 38-41)

76. By lengthening the south jetty to a position opposite the tip of the north jetty, flood flow patterns (Photos 38 and 39) indicate a good division of flow around the toes of both jetties (as compared with plan 1A, Photos 18 and 19). The problem of possible erosion to the sand dike portion of the south jetty during early ebb flow (Photo 40) can be seen as water stored behind the south sand dike accelerated toward the navigation channel. It was noted that this was a short-term occurrence during each tidal cycle just after high-water slack going into ebb flow and was not indicated during peak ebb flow (Photo 41), since flow then was confined to the auxiliary channel.

Plan 1C (Photos 42-45)

77. Surface current photographs of both flood and ebb flows indicated a decrease in surface velocity in the auxiliary channel of at least 0.5 fps after widening the auxiliary channel into Oaks Creek to 300 ft. A further velocity decrease probably would result as the channel enlarges itself naturally after construction. Also, after widening the auxiliary channel, early ebb flow (Photo 44) indicated slightly slower surface velocities than those of plan 1B in the vicinity where the sand dike joins the south jetty.

Plan 7A (Photos 46-49)
and plan 7B (Photos 50-53)

78. The discussion of plans 7A and 7B was combined because of similarity of surface current results. The widening of the auxiliary channel from 200 ft for plan 7A to 300 ft for plan 7B was the only difference in design of both plans. Although plan 7B with its wider auxiliary channel did indicate slightly slower flood velocities in that area (compare Photo 47 for plan 7A and Photo 51 for plan 7B), no difference was evident for ebb currents. Fast ebb currents for both plans (Photos 49 and 53) showed a definite trend to swing close to the south

jetty similar to plan 7 (Photo 37). During early ebb (Photos 48 and 52), currents of about 1 fps were observed close to the location where the sand dike and south jetty join.

Wave Tests

79. Plans 1B and 7A were tested for the wave conditions described in paragraph 59 for which base data had been collected. Wave tests were not made for plans 1C and 7B, since there was not enough change between these plans and the ones tested to warrant the additional testing. Tables 14-37 include all the data collected for the two plans. The data were compared with the base data taken at identical locations. Locations for the gages for plan 1B are shown in Plate 104 and for plan 7A conditions in Plate 105. There are two sets of gage numbering systems, one for each plan.

80. The wave tests were conducted using 3- and 5-ft wave heights which are larger than the average 2-ft wave for the region. These larger waves are probably more important with respect to causing problems and effecting changes and thus were selected for testing.

81. An examination of the wave data reveals that wave heights at a given location for a given plan can vary significantly depending on the time of the tidal cycle which in turn governs water depth and flow conditions at that point. In general, the largest wave heights occurred during high water, this occurring more often at some gages than at others. For example, waves at gage 6 in the deposition basin were highest during high-water slack 75 percent of the time and during maximum flood the remaining 25 percent of the time. The blocking effect of the weir reduced wave heights during low-water stages. Gages 1-3 had 45 percent of the highest waves during high water, 31 percent during maximum ebb flow, 13 percent during maximum flood, and the remainder during low water. Gage 4, still in the main channel but rather far removed from the ocean entrance, had the highest wave conditions during high-water slack 75 percent of the time and 25 percent of the time during maximum flood when the currents aided wave penetration.

82. In comparing the two plans, plan 7 had the greatest problem with high waves. The southeast wave, approaching almost straight into the jettied entrance, produced waves up to 11.9 ft (for 8-sec, 5-ft ocean wave) at gage 1. Corresponding wave heights at gage 1 for plan 1B were 7.4 ft.

83. Comparison of wave heights in the deposition basin (gage 6) and the entrance channel (gages 2 and 3) for plans 1B and 7A shows smaller waves (often by 1 to 2 ft) for plan 7A.

84. In order to compare wave data for the plans with the base condition, analysis of maximum heights for each gage was made by comparing the maximum base height for a given wave condition with the plan height for that condition and arbitrarily calling a difference of 0.4 ft or less no change. Thus plan 1B showed that 24 percent of the gages indicated increases greater than 0.4 ft for the plan, 33 percent of the gages indicated decreases greater than 0.4 ft, and 43 percent of the gages indicated no change. For plan 7A, 17 percent of the gages indicated greater wave heights than the base, 49 percent indicated smaller heights, and 34 percent indicated no change. Therefore, from this analysis plan 7A effected the greatest reduction in wave heights from the base condition.

Discussion

85. The above discussed data indicated that plans 1B/1C:

- a. Caused less change from the base tidal conditions than plans 7A/7B.
- b. Had higher velocities between the jetties to aid in maintaining navigation depths.

Plans 7A/7B:

- a. Had ebb currents that tended to swing toward the south jetty, rather than following the central navigation channel.
- b. Had the worst high-wave conditions at the entrance.

Thus, the Plans 1B/1C jetty alignment was chosen for further refinement and testing.

PART VII: FINAL TESTING (PLANS 1D-1H)

86. As the final phase of the model study, plans 1B/1C were modified to improve performance of the final plan. The first modification was designated plan 1D and was subjected to detailed testing for tides, velocities, current patterns, and waves. Further refinements were designated plans 1E-1H. These plans were subjected only to those tests necessary to determine the effectiveness of the modification involved.

87. The elements of plan 1D are shown in Figure 24. Changes from the previous plan 1 configurations are:

- a. The jetty spacing was reduced from 900 ft of plans 1B and 1C to 600 ft in order to increase the velocities between the jetties and thus aid in self-maintenance of the channel.
- b. The entrance channel depth was reduced from -12 ft mlw to -10 ft mlw which would minimize the lower low-water levels found in the testing of plans 1B and 1C and would be a more cost-effective depth for this inlet.

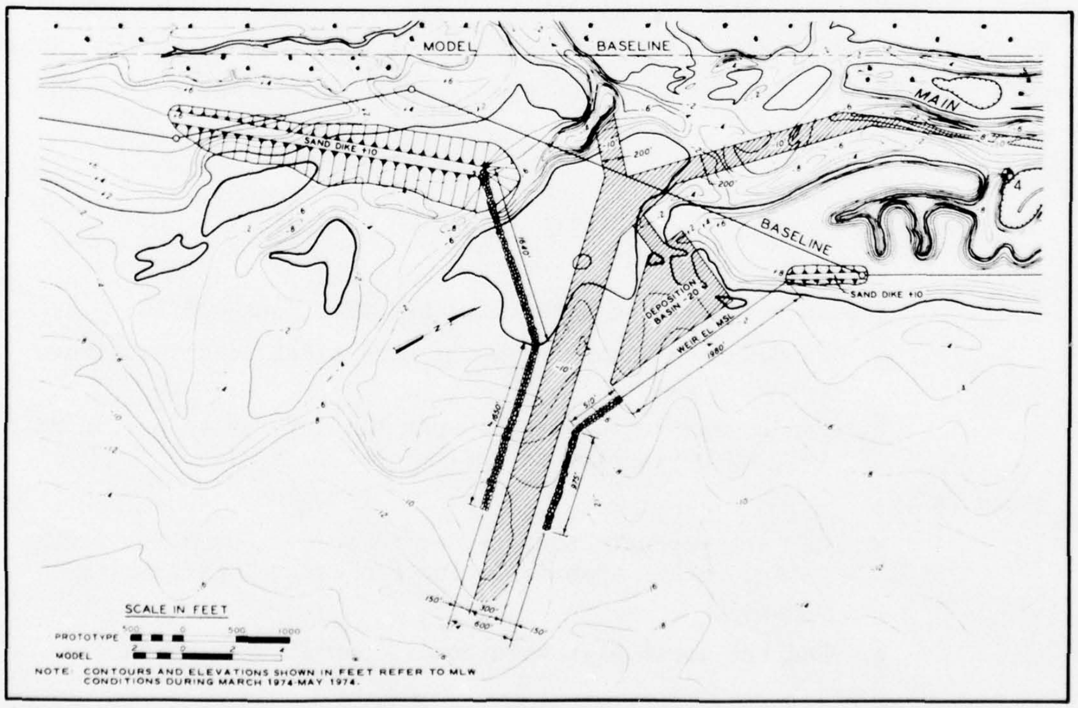


Figure 24. Plan 1D

c. The inner channel depth through Main Creek was reduced from -10 ft to -8 ft mlw for the same reasons as b.

d. The inner channel between velocity sta 11A and 12A was widened from 100 to 200 ft to reduce high velocities observed in this reach (Plate 75).

e. The depth of the 200-ft-wide auxiliary channel of plan 1B was selected and the depth was increased from -6 ft to -10 ft mlw to reduce velocities in the auxiliary channel.

f. The deposition basin was increased in depth (by 8 ft) and in its lateral dimensions (by 245,000 sq ft) which were accommodated by approximately a 350-ft westward shift of the weir section. This size increase was desired so that the basin would handle the gross quantity of littoral drift from the north for a 2- to 3-year duration.

g. The south jetty, besides being shifted northward to decrease jetty spacing, was reoriented from near its midpoint bayward. This change permitted the stone section to cross the existing navigation channel rather than having the sand dike span this region, which would probably be a difficult construction task in this high-velocity region.

h. The weir length was increased from 1,300 to 1,980 ft (this eliminated inner end of north jetty).

i. The length of outer leg of north jetty was decreased from 1,300 to 975 ft.

j. Alignment of sand dike on north jetty was changed.

k. The south jetty sand dike was slightly reoriented and the bend eliminated.

l. A sharper angle was established between auxiliary channel and entrance channel.

m. The first bend in navigation channel (at junction of auxiliary channel) was shifted about 300 ft inland.

n. The entrance channel was rotated a few degrees clockwise.

o. The deposition basin access channel was enlarged.

Plan 1D

88. As shown in Tables 38-40, plan 1D resulted in very little difference in tidal conditions compared with plans 1B/1C. Differences in tidal amplitudes and mean tide levels were considerably less than 0.1 ft and phase differences were less than 6 min (generally less than 2 min).

At gages 1-3, arrival times were slightly earlier, whereas for gages 4-7, arrival times were slightly later (when compared with plans 1B/1C). Tidal plots for plan 1D are presented in Plates 106-109.

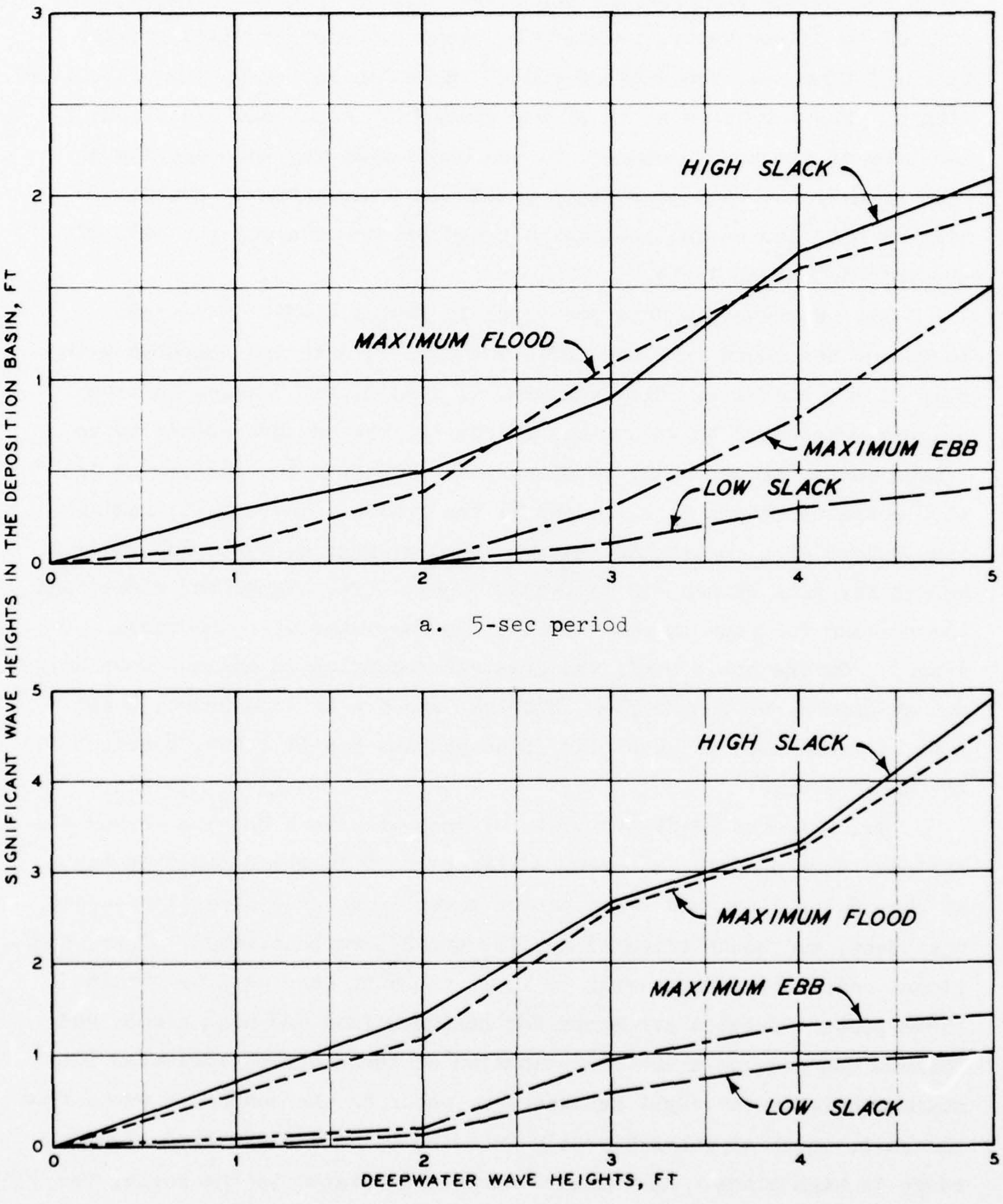
89. Data were collected at the same relative locations as for plan 1B (Plates 2 and 74 for location). The velocities are compared with plans 1B and 1C data in Plates 110-121. Sta 7A velocities (Plate 110) showed the increase caused by reducing jetty width. Maximum velocities were about 1 fps greater than those for plans 1B/1C, although there was essentially no change at sta 8A (Plate 111). Sta 9A and 9B (Plates 112 and 113) indicated that plan 1D caused a shift of ebb flow toward the deposition basin side of the channel, relative to plan 1B. Plans 1C and 1D had lower ebb velocities at sta 9A than at sta 9B, whereas the opposite was true for plan 1B. Maximum ebb velocities at sta 10A (Plate 114) were significantly reduced (about 1.5 fps) by deepening the auxiliary channel, and maximum ebb and flood velocities at sta 11A (Plate 115) were reduced (by about 1 to 2 fps) by widening the transition channel between the entrance and bay channels. Velocities at sta 12A (Plate 116) showed slight reductions from previous testing. Range 3 (Plates 117 and 118) showed slight changes (relative to plans 1B/1C) due to the different channel geometries. Velocities in the lagoon (ranges 4-6, Plates 119-121) had only minor variations from plan 1B data.

90. Plan 1D configuration was designed specifically to increase entrance channel velocities by decreasing the distance between the jetties from 900 to 600 ft, and thereby reduce the likelihood of substantial channel shoaling. Comparison of Photos 42 and 43 for plan 1C and Photos 54 and 55 for plan 1D indicated a new increase in surface velocities by 0.5 fps for flood flow for plan 1D. Approximately the same increase was noted during ebb flow (compare Photos 44 and 45 for plan 1C and Photos 56 and 57 for plan 1D). Although increases in velocities were observed in the navigation channel, it was also noted that a substantial ebb flow developed through the deposition basin and along the weir and north jetty (Photo 57). This pattern, in a reverse direction, also occurred during early flood flow (Photo 54). This flow through the

basin was caused primarily by the relocation of the weir section in plan 1D to deeper water, relative to plan 1C, which provided greater depth of flow near the seaward end of the basin during intermediate tide stages. The increased depth of the deposition basin and the slight relocation of the access channel to the basin also may have aggravated this situation. This eventually could cause the entrance channel to migrate into the basin, leading to potential scour along the base of the weir and north jetty.

91. Wave-height data are shown in Tables 41-52. Wave-gage locations are shown in Plate 122. The plan 1D data are compared with plan 1B and the base. Although several significant changes in wave heights were noted between plans 1B and 1D, the changes appear to be random and no trends could be discerned. For example, inside the jettied entrance (gages 2, 3, 4, and 6) the greatest increase of maximum wave height at a particular gage occurred at gage 6, where the maximum height for plan 1B was 4.0 ft (east, 5 sec, 5 ft, high-water slack) and the maximum for plan 1D was 4.9 ft (same deepwater wave and tidal stage). On the other hand, the greatest reduction in maximum wave height was at gage 2, where the plan 1B height was 9.4 ft (southeast, 8 sec, 5 ft, maximum ebb) and the plan 1D height was 5.9 ft (east, 8 sec, 5 ft, low-water slack).

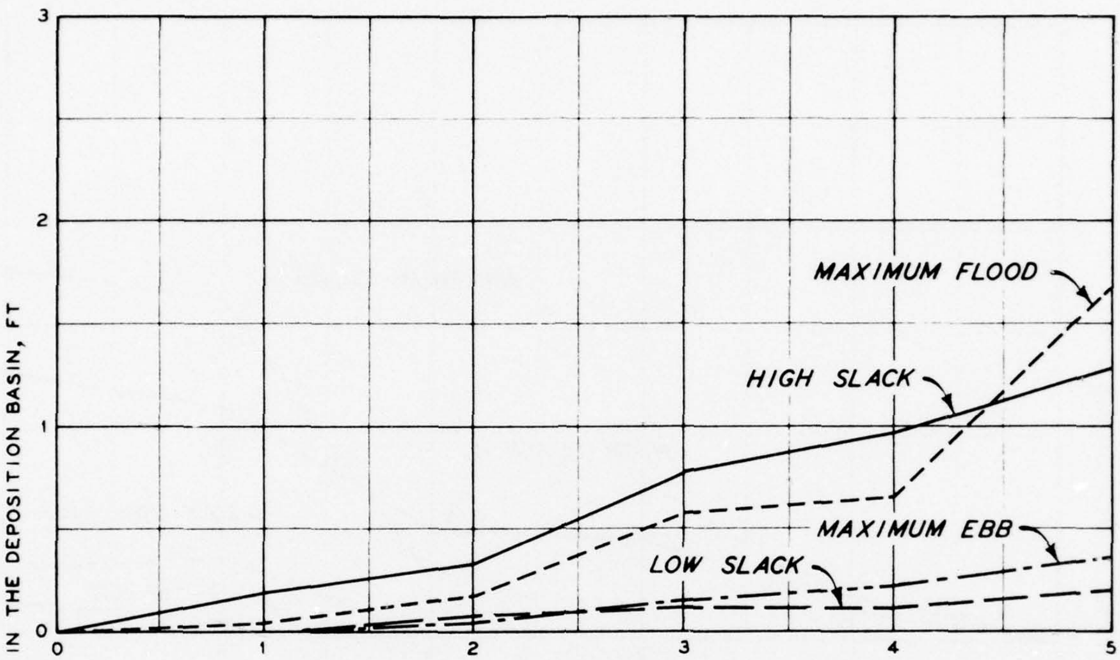
92. Figures 25-27 are plots of deepwater wave heights versus significant wave heights, as measured for plan 1D in the deposition basin at gage 6 for 5-sec and 8-sec period waves from three directions--east, southeast, and south (Figures 25, 26, and 27, respectively). Three additional deepwater wave heights of 1, 2, and 4 ft were used to obtain these plots. Heights are shown for maximum flood and high slack, and maximum ebb and low slack. Examination of these curves indicates that maximum heights, as might be expected, occur in the basin for waves from the east, which approach directly into the basin and the time of occurrence is high slack. As the wave direction rotates to the south, the maximum wave height is reduced as the time of occurrence of the maximum wave height tends to be during the maximum flood flow period. Another trend is that the wave heights in the basin for the 8-sec period wave



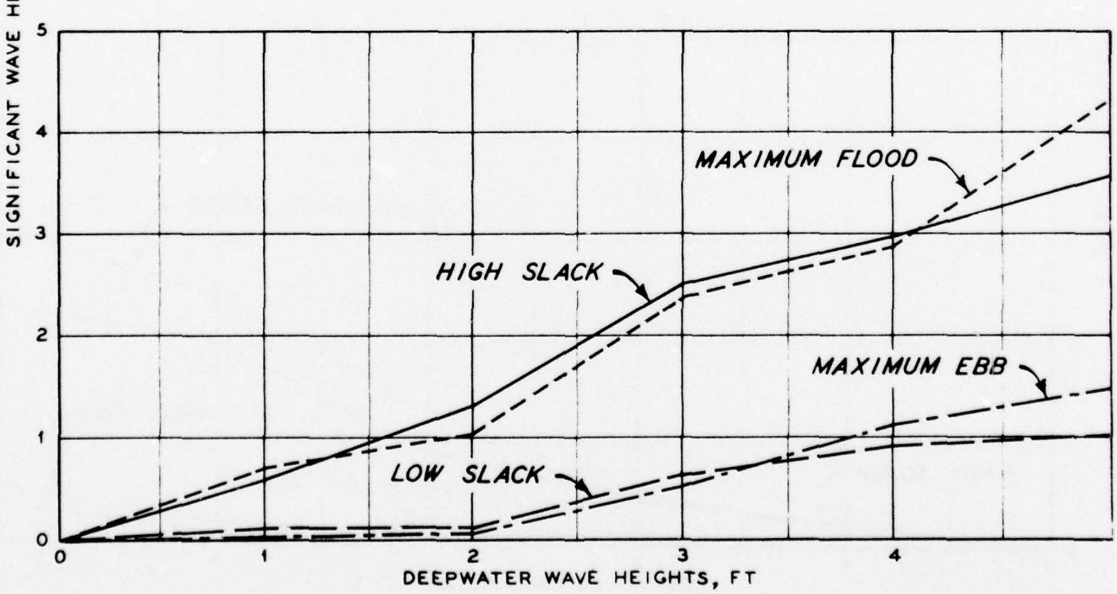
a. 5-sec period

b. 8-sec period

Figure 25. Plan 1D deepwater wave heights (from east) versus wave heights in deposition basin



a. 5-sec period



b. 8-sec period

Figure 26. Plan 1D deepwater wave heights (from southeast) versus wave heights in deposition basin

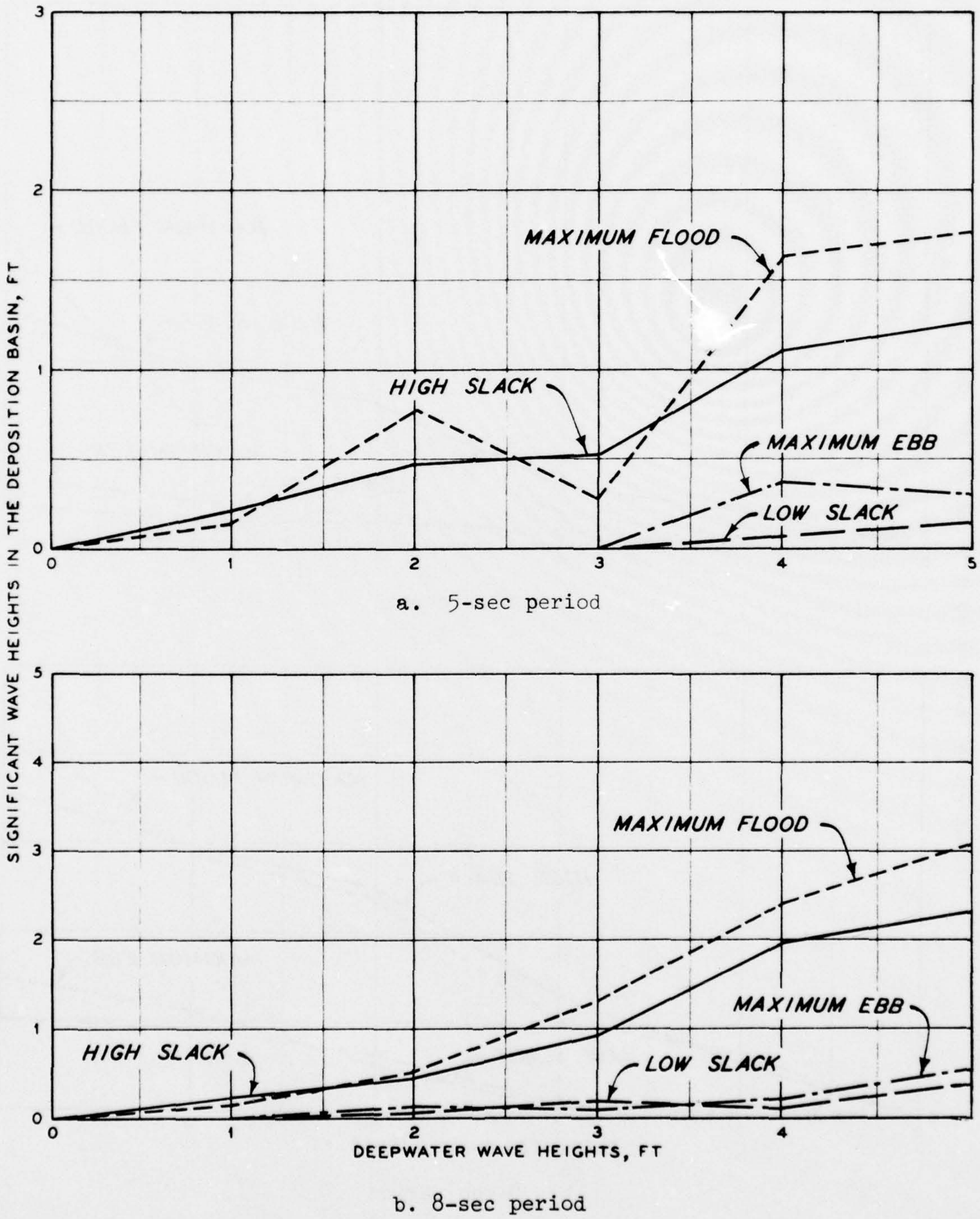


Figure 27. Plan 1D deepwater wave heights (from south) versus wave heights in deposition basin

are usually about double the height of that of the 5-sec period wave.

93. The objectives of plan 1D, to increase velocities in the entrance channel without causing detrimental effects on tides, wave heights, and velocities, were achieved except for one problem area. This problem was the migration of currents through the deposition basin and along the inside portion of the north jetty. The flow through the basin was caused primarily by the movement of the weir section in plan 1D to deeper water relative to the previous versions of plan 1. This allowed the current to flow parallel to the weir. The deepness of the deposition basin and the location of the access channel to the deposition basin also may have aggravated this situation. This flow condition needed to be eliminated or else there would be a strong possibility that the entrance channel would migrate into the deposition basin. Such a situation probably could cause scour along the base of the weir and north jetty, prevent sediment from depositing in the basin, and cause sediment deposition in the dredged navigation channel, thus defeating the purpose of the basic design.

Plan 1E

94. In order to correct the flow problem, the following modifications were made to plan 1D and identified as plan 1E:

a. The access channel to the deposition basin was relocated (Figure 28).

b. A 500-ft-long training dike (parallel to the navigation channel) was added at the bend in the north jetty to prevent high-velocity ebb flow along the weir and north jetty.

95. Results of the tidal observations are presented in Plates 123-126 and Tables 53-55. Compared with plan 1D results, tidal amplitudes and mean tide levels were changed by less than 0.1 ft, and tidal phases were delayed at all gages by about 3-7 min.

96. Comparison of Photos 58-61 for plan 1E with Photos 54-57 for plan 1D indicates an effective swing of the flow back toward the navigation channel, but maximum ebb currents (Photo 57 for plan 1D and

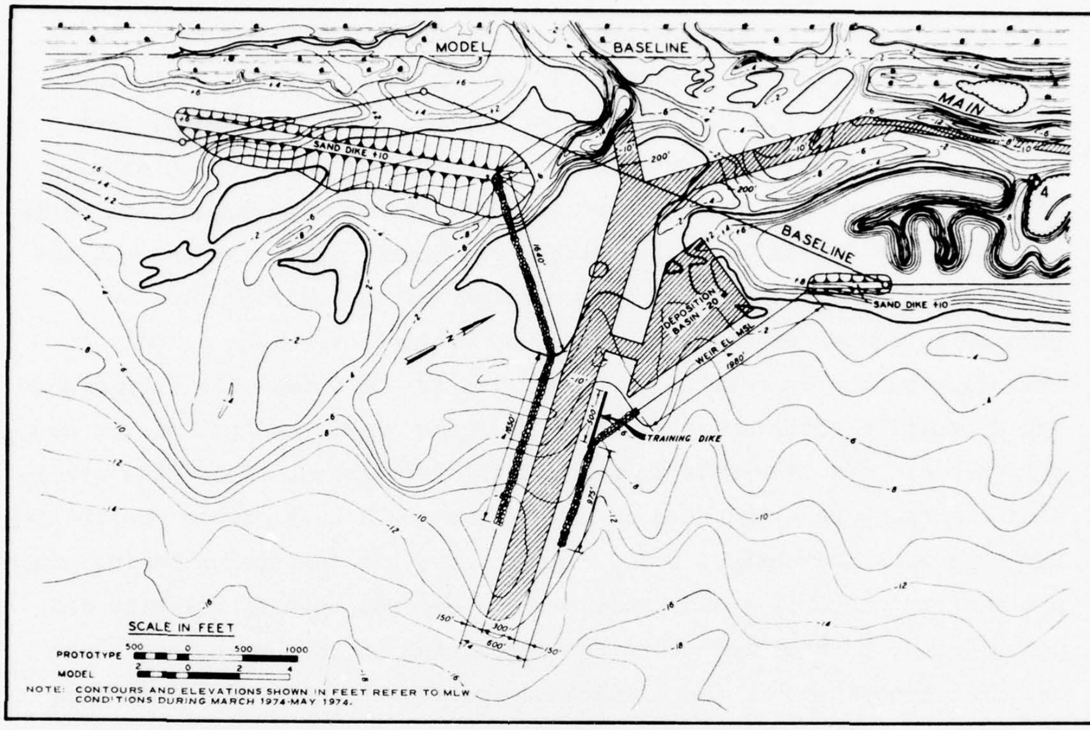


Figure 28. Plan 1E

Photo 61 for plan 1E) continued to indicate a tendency for flow to be drawn through the deposition basin and around the tip of the training dike. These velocities approached 3 fps as water was drawn toward the entrance channel (Photo 61). Fast surface velocities also were noted during maximum ebb flow (Photo 61) in the old channel entering the bayward end of the basin.

Plan 1F

97. Plan 1F was another proposal similar in concept to plan 1E but less expensive (Figure 29). This modification consisted of replacing the training dike with a 900-ft-long sand dike constructed to an elevation of -2 ft mlw. It was hoped that this would result in slowing the faster velocities occurring during low water.

98. Photos 62-65 show the surface current patterns for plan 1F. Photo 65, in particular, shows that this plan was ineffective in

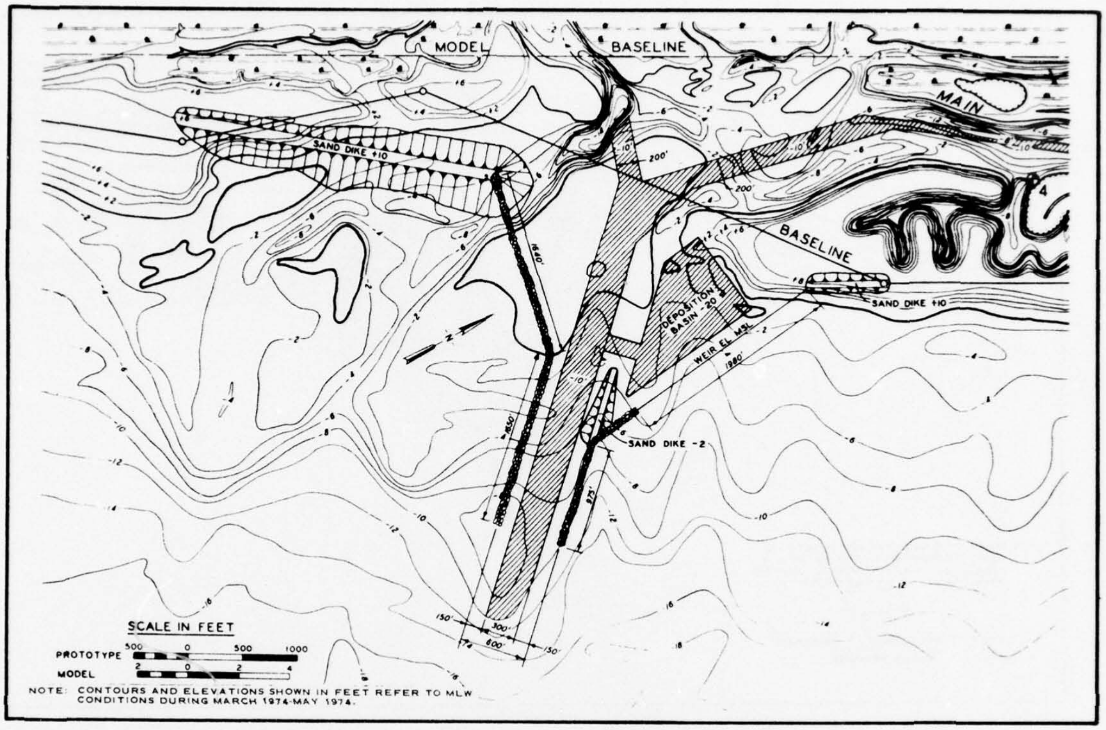


Figure 29. Plan 1F

eliminating the undesirable flow through the deposition basin. Also it was believed that in the presence of only minor wave action, the potential existed for the deterioration of the sand dike, possibly in a relatively short period of time.

99. As shown in Tables 53-55, there was little change in tidal data from plan 1E to plan 1F.

Plan 1G

100. Since plans 1E and 1F did not alleviate the flow problems in the deposition basin, a different approach was tried. A curved, rubble training dike on the southern end of the Garden City spit was constructed to a constant crest elevation of +9 ft mlw. This plan was designated plan 1G (Figure 30).

101. Surface current patterns for plan 1G are presented in Photos 66-69. Plan 1G virtually eliminated the tendency for the ebb

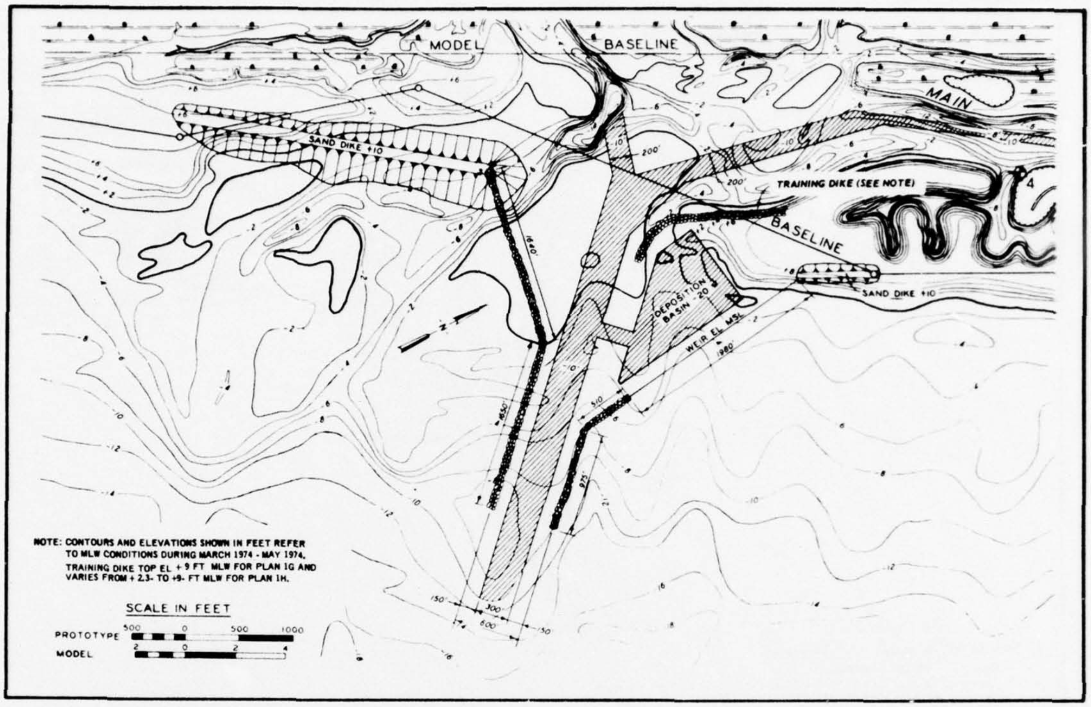


Figure 30. Plans 1G and 1H

current to migrate through the deposition basin at low water (Photo 69). However, a relatively strong current was observed at the end of the training dike during flood flow (Photo 67) which has the potential for scouring. Also tidal currents at both peak flood (Photo 67) and peak ebb (Photo 69) deviate from the center of the dredged channel.

102. There was very little difference between plan 1G and plan 1E data as shown in Tables 53-55.

Plan 1H

103. A variation of plan 1G was designed that consisted of using a rubble training dike as described for plan 1G but having a variable height crest. The height of the training dike was held at a constant minimum elevation of mean tide level (+2.3 ft mlw) at all points where the present elevation of the spit was less than this height. This design allowed flow over the dike when the weir section was in operation,

thus minimizing high-velocity currents around the tip of the dike. At points on the spit where the present elevation was greater than mean tide level, the height of the training dike varied linearly from the +2.3 mlw elevation until an elevation of +9.0 ft mlw was reached. This plan was designated plan 1H (Plates 127-143).

104. Surface current photographs for plan 1H (Photos 70-73) indicated, as did plan 1G, a significant reduction of migration of tidal currents through the basin. In addition, the lower height of the end of the training dike reduced the high velocities at the end of the dike during flood flow near the time of high water (Photo 71). The tendency for flow to deviate slightly from the center of the dredged channel still appeared but was not considered a serious problem.

105. There was no change in tidal conditions compared with plan 1G, as shown in Tables 53-55.

106. Since this plan appeared to be the best solution, a full set of velocity data was collected. Locations for data collection for plan 1H are shown in Plate 131 and were identical with those for plan 1D. Results are presented in Plates 132-143. Velocities at sta 7A and 8A (Plates 132 and 133) showed little change from plan 1D, except that the maximum surface ebb velocity for plan 1H was 0.8 fps higher than that for plan 1D. At sta 9A and 9B (Plates 134 and 135) the effect of reducing flow through the deposition basin increased maximum flood and ebb currents (by about 0.5 to 1.7 fps) at these locations in the main navigation channel for plan 1H. Sta 10A (Plate 136) currents indicated virtually no change in the auxiliary channel. Velocities at sta 11A and 12A (Plates 137 and 138) showed essentially no change in the interior channel except at sta 11A where maximum surface ebb currents were about 0.8 fps higher due to the confining of surface flow by the training dike. Observations at sta 3A-3D (Plates 139 and 140) indicated velocity adjustments (generally less than 0.5 fps) due to the dike when compared with plan 1D data. Ranges 4-6 (Plates 141-143) in the lagoon had no significant changes compared with plan 1D data.

107. The narrowing of the jetty system to 600 ft makes it important to examine the effect, if any, of this constricted passageway

on the flow volume of water entering the lagoon. The tidal prism as calculated by the cubature method[7] for the base condition was 253,373,000 cu ft; the tidal prism for plan 1H was calculated to be 258,641,000 cu ft. Thus there was no significant change in the tidal prism.

PART VIII: CONCLUSIONS AND RECOMMENDATIONS

108. Based on the model test results and subsequent analysis, the following conclusions and recommendations are made:

<u>a</u>. Of the plans tested, plan 1H was the optimal plan for providing a stable entrance channel while minimizing other deleterious effects. The plan contains the following elements:

(1) <u>North jetty</u>. The north quarrystone jetty would be composed of a low weir section approximately 1,330 ft long and constructed to a +2.2 ft mlw elevation flanked by a seaward section extending approximately 1,505 ft to the -10 ft mlw ocean contour and a shoreward section approximately 518 ft long, each with a top elevation of +9.0 ft. The total length would be approximately 3,455 ft.

(2) <u>South jetty</u>. The south jetty also would be constructed of quarrystone and would extend approximately 3,330 ft to the -10 ft mlw ocean contour with a top elevation of +9 ft mlw. Also, an 8-ft wide fishing walkway will be constructed on the crest of the south jetty to el +10.0 ft mlw.

(3) <u>Sand dikes</u>. Sand dikes would be constructed from the shoreward ends of the north and south stone jetties to the existing dune line at el +10 ft mlw.

(4) <u>Deposition basin</u>. A deposition basin 18 to 20 ft deep and of 600,000 cu yd capacity would be dredged adjacent to the low weir section of the north jetty on the inlet side.

(5) <u>Entrance channel</u>. The entrance channel would extend inland from the -10 ft mlw ocean contour for a distance of approximately 3,000 ft and would be 300 ft wide and 10 ft deep at mlw.

(6) <u>Inner channels</u>. An inner channel 200 ft wide and 10 ft deep would extend to the mouth of Main Creek, a length of approximately 1,850 ft. Another inner channel, 90 ft wide and 8 ft deep would be 13,590 ft long, from the mouth of Main Creek to the old Army Crash Boat Dock, with a turning basin at the inner end (150 by 300 ft). An auxiliary channel 200 ft wide and 10 ft deep also would be constructed from the entrance channel to the -10 ft mlw contour at the mouth of Oaks Creek, a length of approximately 670 ft.

(7) Training dike. A variable height training dike approximately 1,500 ft long would extend from el +9.0 ft mlw on the Garden City spit to el +2.3 ft mlw and maintain this elevation for the remainder of its length, approximately 1,000 ft.

b. Plan 1H would not have a significant impact on tidal conditions. The maximum changes would be about 0.3 ft in tidal amplitude, 0.2 ft in mean tide level, and 11 min in tidal phasing.

c. The general entrance alignment of plan 1 is preferable to that of plan 7 because there would be less change to tidal conditions in the bay, entrance velocity conditions would be more conducive to a self-maintaining channel, and flow patterns would be better aligned with the dredged channel in the entrance.

d. The jetties should be of such lengths that a line perpendicular to the channel axis passes through both jetty tips. This will produce a uniform flood flow pattern into the entrance and prevent crosscurrents.

e. The jetty spacing should be 600 ft in order to provide adequate scouring currents.

f. The auxiliary channel connecting the navigation channel to Oaks Creek should be 200 ft wide by 10 ft deep in order to provide moderate velocities.

g. A transition channel between the navigation channel and the lagoon channel should be 200 ft wide by 10 ft deep to provide moderate velocities.

h. The bay channel depth should be 8 ft deep rather than 10 ft deep in order to prevent, as much as possible, changes to the lagoon low-water level.

i. The deposition basin access channel should be placed perpendicular to the navigation channel (as in Figure 30) so as not to induce tidal flow into the basin.

j. A training dike is required at the end of Garden City spit to prevent migration of flow through the deposition basin, and the training dike should be of variable height to prevent scour at its seaward end.

k. It is recommended that a program of periodic inspection be followed to determine if either maintenance dredging of the channels or supplemental repair of the training dike is required.

l. Plan 1H will not cause a significant change to the tidal prism.

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Table 1

Prototype Tidal Constituents, Gage 8

Component	H, ft	κ, deg	Component	H, ft	κ, deg
J_1	0.0175	106.75	L_2	0.0673	214.91
K_1	0.2623	112.04	N_2	0.5628	1[illegible]7.69
M_1	0.0157	117.33	S_2	0.3635	214.63
O_1	0.2209	112.62	S_4	0.0342	49.64
P_1	0.0868	112.04	S_6	0.0083	356.56
Q_1	0.0429	127.91	P_2	0.0029	214.63
ρ_1	0.0084	127.17	T_2	0.0214	214.63
M_2	2.4020	201.30	ν_2	0.1092	189.51
M_4	0.0106	23.13	$2N_2$	0.0749	174.08
M_6	0.0065	152.89	$2Q_1$	0.0056	133.20
M_8	0.0109	311.58	OO_1	0.0095	101.46
K_2	0.0989	214.63	λ_2	0.0168	207.49

Note: For a more detailed explanation of components see Reference 6.

Table 2

Verification of M_2 Constituent Tidal Amplitudes (ft)

Gage	Prototype	Run No. 1 Model	Run No. 1 Difference	Run No. 36 Model	Run No. 36 Difference	Run No. 73 Model	Run No. 73 Difference
1	1.79	2.15	+0.36	1.80	+0.01	1.72	-0.07
2	1.83	2.14	+0.31	1.92	+0.09	1.79	-0.04
3	1.87	2.07	+0.20	1.92	+0.05	1.80	-0.07
4	1.92	2.26	+0.34	1.97	+0.05	1.88	-0.04
5	1.89	2.22	+0.33	1.96	+0.07	1.84	-0.05
6	1.94	2.27	+0.33	1.99	+0.05	1.87	-0.07
7	1.87	1.95	+0.08	1.89	+0.02	1.82	-0.05
8	2.40	2.43	+0.03	2.41	+0.01	2.40	-0.00

Table 3

Verification of M_2 Constituent Phase Differences from Ocean Gage (deg*)

Gage to Gage	Prototype	Run No. 1 Model	Run No. 1 Difference	Run No. 36 Model	Run No. 36 Difference	Run No. 73 Model	Run No. 73 Difference
8-1	48.2	30.5	-17.7	45.1	-3.1	49.2	+1.0
8-2	33.4	26.5	-6.9	32.2	-1.2	34.2	+0.8
8-3	19.5	13.8	-5.7	19.2	-0.3	20.2	+0.7
8-4	20.7	13.8	-6.9	21.4	+0.7	20.3	-0.4
8-5	32.7	23.9	-8.8	32.3	-0.4	33.1	+0.4
8-6	33.2	21.2	-12.0	32.0	-1.2	32.5	-0.7
8-7	47.1	41.0	-6.1	44.5	-2.6	46.8	-0.3

* 1 degree = 2.07 minutes of prototype time.

Table 4

M_2 Constituent Phase Differences Between Interior Gages (deg*)

Gage to Gage	Prototype	Run No. 1		Run No. 36		Run No. 73	
		Model	Difference	Model	Difference	Model	Difference
2-1	14.8	4.6	-10.2	12.9	-1.9	15.0	+0.2
3-1	28.7	17.3	-11.4	25.9	-2.8	29.0	+0.3
3-2	13.9	12.7	-1.2	13.0	-0.9	14.0	+0.1
4-5	12.0	10.1	-1.9	10.9	-1.1	12.8	+0.8
4-6	12.5	7.4	-5.1	10.6	-1.9	12.2	-0.3
4-7	26.4	27.2	+0.8	23.1	-3.3	26.5	+0.1
5-6	0.6	-2.7	-3.3	-0.3	-0.9	-0.6	-1.2
6-7	13.8	19.7	+5.9	12.5	-1.3	14.3	+0.5

* 1 degree = 2.07 minutes of prototype time.

Table 5

Verification of M_2 Constituent Mean Tide Levels (ft mlw)

Gage	Prototype	Run No. 1		Run No. 36		Run No. 73	
		Model	Difference	Model	Difference	Model	Difference
1	2.67	2.83	+0.16	2.50	-0.17	2.73	+0.06
2	2.67	2.83	+0.16	2.43	-0.24	2.70	+0.03
3	2.70	2.63	-0.07	2.25	-0.45	2.55	-0.15
4	2.72	2.73	+0.01	2.38	-0.34	2.66	-0.06
5	2.70	2.79	+0.09	2.43	-0.27	2.68	-0.02
6	2.68	2.76	+0.08	2.39	-0.29	2.66	-0.03
7	2.68	3.01	+0.33	2.52	-0.16	2.76	+0.08
8	2.34	2.56	+0.22	2.13	-0.21	2.37	+0.03

Table 6

Preliminary Plan Tests

Comparison of Tidal Amplitudes of the Principal Lunar Constituent (ft)

Gage	Base	Plan 1	Difference from Base	Plan 2	Difference from Base	Plan 4	Difference from Base	Plan 6	Difference from Base	Plan 7	Difference from Base
1	1.73	1.79	+0.06	1.79	+0.06	1.91	+0.18	1.90	+0.17	1.83	+0.10
2	1.85	1.85	0.00	1.85	0.00	1.99	+0.14	1.98	+0.13	1.89	+0.04
3	1.87	1.87	0.00	1.87	0.00	2.02	+0.15	2.01	+0.14	1.92	+0.05
4	1.93	2.12	+0.19	2.13	+0.20	2.32	+0.39	2.33	+0.40	2.13	+0.20
5	1.89	1.94	+0.05	1.95	+0.06	2.08	+0.19	2.08	+0.19	1.98	+0.09
6	1.93	2.11	+0.18	2.11	+0.18	2.29	+0.36	2.30	+0.37	2.10	+0.17
7	1.77	1.86	+0.09	1.87	+0.10	1.94	+0.17	1.93	+0.16	1.86	+0.09
8	2.43	2.44	+0.01	2.44	+0.01	2.44	+0.01	2.45	+0.02	2.42	-0.03

Table 7

Preliminary Plan Tests

Comparison of Mean Tide Levels of the Principal Lunar Constituent

(ft mlw)

Gage	Base	Plan 1	Difference from Base	Plan 2	Difference from Base	Plan 4	Difference from Base	Plan 6	Difference from Base	Plan 7	Difference from Base
1	2.76	2.67	-0.09	2.71	-0.05	2.70	-0.06	2.67	-0.09	2.70	-0.06
2	2.70	2.64	-0.06	2.69	-0.01	2.65	-0.05	2.62	-0.08	2.65	-0.05
3	2.52	2.48	-0.04	2.53	+0.01	2.46	-0.06	2.43	-0.09	2.50	-0.02
4	2.65	2.49	-0.16	2.54	-0.11	2.40	-0.25	2.37	-0.28	2.50	-0.15
5	2.69	2.61	-0.08	2.66	-0.03	2.58	-0.11	2.55	-0.14	2.63	-0.06
6	2.66	2.52	-0.14	2.58	-0.08	2.44	-0.22	2.41	-0.25	2.55	-0.11
7	2.81	2.74	-0.07	2.79	-0.02	2.74	-0.07	2.72	-0.09	2.76	-0.05
8	2.39	2.30	-0.09	2.34	-0.05	2.35	-0.04	2.31	-0.08	2.34	-0.05

Table 8

Preliminary Plan Tests

Comparison of Phase Differences of the Principal Lunar Constituent (deg*)

Gage to Gage	Base	Plan 1	Difference from Base	Plan 2	Difference from Base	Plan 4	Difference from Base	Plan 6	Difference from Base	Plan 7	Difference from Base
8-1	50.1	50.9	+0.8	51.3	+1.2	41.4	-8.7	42.4	-7.7	46.2	-3.9
8-2	34.7	39.5	+4.8	39.9	+5.2	30.0	-4.7	30.9	-3.8	35.3	+0.6
8-3	19.9	28.4	+8.5	28.8	+8.9	16.4	-3.5	17.2	-2.7	21.7	+1.8
8-4	21.3	18.4	-2.9	18.6	-2.7	9.9	-11.4	10.4	-10.9	18.9	-2.4
8-5	33.9	31.9	-2.0	32.3	-1.6	24.5	-9.4	-.1	- 8.8	32.0	-1.9
8-6	33.1	27.2	-5.9	27.8	-5.3	19.7	-13.4	20.2	-12.9	29.3	-3.8
8-7	51.0	44.4	-6.6	45.0	-6.0	39.4	-11.6	40.1	-10.9	+6.0	-5.0

* 1 degree of phase lag equals 2.7 minutes of prototype time.

Table 9

Preliminary Testing

Variations in High- and Low-Water Elevations for Plans 1, 2, 4, 6, and 7 with Respect to the Base Condition

Gage	High-Water Variation from Base Condition, ft, for Plans					Low-Water Variation from Base Condition, ft, for Plans				
	1	2	4	6	7	1	2	4	6	7
1	-0.1	-0.05	0.05	0.00	0.00	-0.1	-0.1	-0.2	-0.2	-0.1
2	-0.05	-0.05	0.05	0.00	0.00	-0.1	-0.05	-0.2	-0.2	-0.1
3	-0.1	0.00	0.05	0.00	0.00	-0.15	-0.1	-0.25	-0.3	-0.15
4	-0.1	-0.05	0.00	0.00	-0.05	-0.40	-0.35	-0.6	-0.65	-0.35
5	-0.05	0.00	0.05	0.00	0.00	-0.20	-0.15	-0.3	-0.3	-0.2
6	-0.05	0.00	0.05	0.00	0.00	-0.5	-0.35	-0.7	-0.75	-0.45
7	0.00	0.05	0.10	0.05	0.00	-0.15	-0.1	-0.2	-0.2	-0.1

Table 10

Detailed Plan Tests

Comparison of Tidal Amplitudes of the Principal Lunar Constituent (ft)

Gage	Base II	Plan 1B	Difference from Base	Plan 1C	Difference from Base	Plan 7A	Difference from Base	Plan 7B	Difference from Base
1	1.72	1.75	+0.03	1.75	+0.03	1.87	+0.15	1.88	+0.16
2	1.79	1.86	+0.07	1.86	+0.07	2.05	+0.26	2.06	+0.27
3	1.80	1.87	+0.07	1.87	+0.07	2.24	+0.44	2.26	+0.46
4	1.88	2.25	+0.37	2.27	+0.39	2.20	+0.32	2.21	+0.33
5	1.84	1.97	+0.13	1.98	+0.14	2.09	+0.25	2.10	+0.26
6	1.87	2.20	+0.33	2.22	+0.35	2.17	+0.30	2.19	+0.32
7	1.82	1.89	+0.07	1.90	+0.08	1.89	+0.07	1.89	+0.07
8	2.40	2.40	+0.00	2.43	+0.03	2.42	+0.02	2.42	+0.02

Table 11

Detailed Plan Tests

Comparison of Mean Tide Levels of the Principal Lunar Constituent

(ft mlw)

Gage	Base II	Plan 1B	Difference from Base	Plan 1C	Difference from Base	Plan 7A	Difference from Base	Plan 7B	Difference from Base
1	2.73	2.72	-0.01	2.74	+0.01	2.69	-0.04	2.76	+0.03
2	2.70	2.67	-0.03	2.69	-0.01	2.58	-0.12	2.64	-0.06
3	2.55	2.53	-0.02	2.54	-0.01	2.36	-0.19	2.42	-0.13
4	2.66	2.41	-0.25	2.40	-0.26	2.50	-0.16	2.55	-0.11
5	2.68	2.61	-0.07	2.60	-0.08	2.57	-0.11	2.62	-0.06
6	2.66	2.46	-0.20	2.44	-0.22	2.53	-0.13	2.58	-0.08
7	2.76	2.72	-0.04	2.72	-0.04	2.80	-0.04	2.84	+0.08
8	2.37	2.34	-0.03	2.33	-0.04	2.35	-0.02	2.41	+0.04

Table 12

Detailed Plan Tests

Comparison of Phase Differences of the Principal Lunar Constituent (deg*)

Gage	Base II	Plan 1B	Difference from Base	Plan 1C	Difference from Base	Plan 7A	Difference from Base	Plan 7B	Difference from Base
8-1	49.2	49.9	+0.7	50.3	+1.1	44.5	-4.7	43.2	-6.0
8-2	34.2	33.0	-1.2	32.7	-1.5	28.4	-5.8	27.1	-7.1
8-3	20.2	22.1	+1.9	21.6	+1.4	10.7	-9.5	9.1	-11.1
8-4	20.3	12.2	-8.1	11.6	-8.7	17.7	-2.6	16.7	-3.6
8-5	33.1	27.4	-5.7	27.4	-5.7	29.0	-4.1	28.0	-5.1
8-6	32.5	23.1	-9.4	23.0	-9.5	27.4	-5.1	26.4	-6.1
8-7	46.8	42.0	-4.8	43.0	-3.8	46.4	-0.4	45.8	-1.0

* 1 degree of phase lag equals 2.07 minutes of prototype time.

Table 13

Detailed Testing

Variations in High- and Low-Water Elevations for Plans 1B, 1C, 7A, and 7B with Respect to the Base Condition

Gage	High-Water Variation from Base Condition, ft, for Plans				Low-Water Variation from Base Condition, ft, for Plans			
	1A	1B	7A	7B	1A	1B	7A	7B
1	0.0	0.0	+0.1	+0.2	-0.1	-0.05	-0.1	-0.1
2	0.0	0.0	+0.1	+0.2	-0.2	-0.15	-0.45	-0.35
3	0.0	0.0	+0.1	+0.2	-0.2	-0.15	-0.7	-0.7
4	0.0	0.0	0.0	+0.1	-0.7	-0.75	-0.6	-0.6
5	0.0	0.0	+0.05	+0.1	-0.2	-0.15	-0.45	-0.4
6	0.0	0.0	+0.1	+0.15	-0.7	-0.75	-0.6	-0.6
7	0.0	0.0	+0.1	+0.15	-0.2	-0.15	-0.15	-0.1

Table 14

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)
for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 5 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	1.6	2.1	8	Low slack	0.0	0.0
	Maximum flood	2.1	1.7		Maximum flood	*	0.0
	High slack	2.2	3.0		High slack	0.0	0.0
	Maximum ebb	1.5	2.2		Maximum ebb	*	0.0
2	Low slack	1.9	2.0	9	Low slack	0.0	0.1
	Maximum flood	2.0	1.9		Maximum flood	0.3	0.1
	High slack	2.3	2.3		High slack	0.2	0.1
	Maximum ebb	2.2	2.5		Maximum ebb	0.1	0.1
3	Low slack	0.7	0.6	10	Low slack	0.0	0.0
	Maximum flood	1.5	1.1		Maximum flood	0.1	0.0
	High slack	1.7	0.9		High slack	0.1	0.0
	Maximum ebb	1.5	1.2		Maximum ebb	0.0	0.0
4	Low slack	0.0	0.2	11	Low slack	0.0	0.0
	Maximum flood	0.7	0.9		Maximum flood	0.0	0.0
	High slack	0.6	0.7		High slack	0.0	0.0
	Maximum ebb	0.0	0.2		Maximum ebb	0.1	0.1
5	Low slack	1.9	1.8	12	Low slack	0.1	0.0
	Maximum flood	1.7	1.2		Maximum flood	1.2	1.1
	High slack	1.8	1.0		High slack	1.3	1.2
	Maximum ebb	1.6	1.7		Maximum ebb	0.1	0.3
6	Low slack	0.4	0.1	13	Low slack	0.2	0.1
	Maximum flood	0.7	1.4		Maximum flood	1.4	0.7
	High slack	0.7	1.0		High slack	1.4	1.0
	Maximum ebb	0.6	0.3		Maximum ebb	0.5	0.2
7	Low slack	0.0	0.0				
	Maximum flood	0.1	0.0				
	High slack	0.1	0.0				
	Maximum ebb	0.0	0.0				

* ADACS failure.

Table 15

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)
for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 5 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	*	5.1	8	Low slack	0.0	0.0
	Maximum flood	5.5	5.2		Maximum flood	0.0	0.0
	High slack	5.9	5.9		High slack	0.1	0.0
	Maximum ebb	5.4	5.3		Maximum ebb	0.0	0.0
2	Low slack	4.3	3.7	9	Low slack	0.0	0.1
	Maximum flood	4.5	3.1		Maximum flood	0.6	0.2
	High slack	4.1	3.6		High slack	0.3	0.2
	Maximum ebb	5.0	3.8		Maximum ebb	0.1	0.1
3	Low slack	0.9	1.0	10	Low slack	0.0	0.0
	Maximum flood	3.5	1.5		Maximum flood	0.2	0.1
	High slack	3.0	1.5		High slack	0.1	0.1
	Maximum ebb	1.4	2.1		Maximum ebb	0.0	0.0
4	Low slack	0.0	0.3	11	Low slack	0.0	0.0
	Maximum flood	1.4	1.1		Maximum flood	0.0	0.0
	High slack	1.0	1.2		High slack	0.1	0.0
	Maximum ebb	0.0	0.5		Maximum ebb	0.1	0.1
5	Low slack	2.9	2.8	12	Low slack	0.1	0.0
	Maximum flood	4.8	4.3		Maximum flood	1.2	0.7
	High slack	5.3	3.7		High slack	1.0	1.1
	Maximum ebb	3.9	5.1		Maximum ebb	0.3	0.3
6	Low slack	0.5	0.3	13	Low slack	0.3	0.1
	Maximum flood	2.3	2.1		Maximum flood	1.8	1.4
	High slack	2.4	2.5		High slack	1.8	1.4
	Maximum ebb	1.3	1.2		Maximum ebb	0.5	0.6
7	Low slack	0.0	0.0				
	Maximum flood	0.1	0.1				
	High slack	0.1	0.1				
	Maximum ebb	0.0	0.1				

* Gage out of water.

Table 16

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 8 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	*	4.0	8	Low slack	0.0	0.0
	Maximum flood	4.3	4.2		Maximum flood	0.0	0.1
	High slack	4.5	5.1		High slack	0.0	0.1
	Maximum ebb	4.1	3.7		Maximum ebb	0.0	0.0
2	Low slack	1.9	2.7	9	Low slack	0.0	0.2
	Maximum flood	1.7	1.6		Maximum flood	0.3	0.2
	High slack	2.0	1.9		High slack	0.5	0.3
	Maximum ebb	1.5	2.9		Maximum ebb	0.1	0.1
3	Low slack	1.3	0.7	10	Low slack	0.0	0.1
	Maximum flood	3.8	1.5		Maximum flood	0.1	0.0
	High slack	4.0	1.6		High slack	0.1	0.1
	Maximum ebb	1.6	1.3		Maximum ebb	0.0	0.0
4	Low slack	0.0	0.3	11	Low slack	0.0	0.0
	Maximum flood	1.3	0.9		Maximum flood	0.0	0.0
	High slack	1.0	1.5		High slack	0.1	0.0
	Maximum ebb	0.0	0.2		Maximum ebb	0.0	0.1
5	Low slack	3.2	2.8	12	Low slack	0.2	0.0
	Maximum flood	2.9	3.8		Maximum flood	1.1	0.6
	High slack	3.0	2.7		High slack	1.3	1.3
	Maximum ebb	2.9	3.3		Maximum ebb	0.4	0.5
6	Low slack	0.8	0.1	13	Low slack	0.4	0.1
	Maximum flood	2.0	2.4		Maximum flood	2.5	1.6
	High slack	2.6	1.5		High slack	2.6	2.1
	Maximum ebb	1.2	0.6		Maximum ebb	0.6	0.8
7	Low slack	0.0	0.1				
	Maximum flood	0.1	0.1				
	High slack	0.1	0.3				
	Maximum ebb	0.0	0.0				

* Gage out of water.

Table 17

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 8 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	*	6.8	8	Low slack	0.0	0.0
	Maximum flood	6.3	7.4		Maximum flood	0.0	0.1
	High slack	6.3	7.7		High slack	0.1	0.2
	Maximum ebb	6.1	6.3		Maximum ebb	0.0	0.0
2	Low slack	4.4	4.6	9	Low slack	0.0	0.3
	Maximum flood	4.5	3.5		Maximum flood	0.4	0.2
	High slack	4.4	4.6		High slack	0.5	0.3
	Maximum ebb	6.6	4.5		Maximum ebb	0.1	0.1
3	Low slack	1.5	1.0	10	Low slack	0.0	0.2
	Maximum flood	3.4	1.9		Maximum flood	0.1	0.0
	High slack	3.2	2.5		High slack	0.2	0.1
	Maximum ebb	1.7	1.7		Maximum ebb	0.0	0.0
4	Low slack	0.0	0.5	11	Low slack	0.0	0.0
	Maximum flood	1.4	1.1		Maximum flood	0.0	0.0
	High slack	1.6	1.4		High slack	0.1	0.0
	Maximum ebb	0.1	0.3		Maximum ebb	0.0	0.1
5	Low slack	3.9	3.2	12	Low slack	0.3	0.1
	Maximum flood	5.9	4.2		Maximum flood	1.9	0.8
	High slack	7.7	5.7		High slack	1.5	1.4
	Maximum ebb	4.3	4.8		Maximum ebb	0.5	0.5
6	Low slack	1.1	0.3	13	Low slack	0.6	0.3
	Maximum flood	4.4	3.3		Maximum flood	1.6	1.4
	High slack	3.1	4.0		High slack	1.4	1.7
	Maximum ebb	1.8	1.6		Maximum ebb	0.6	0.7
7	Low slack	0.0	0.1				
	Maximum flood	0.1	0.2				
	High slack	0.2	0.5				
	Maximum ebb	0.0	0.0				

* Gage out of water.

Table 18

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 5 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	1.7	2.8	8	Low slack	0.0	0.0
	Maximum flood	2.1	2.3		Maximum flood	0.0	0.0
	High slack	2.0	2.2		High slack	0.0	0.0
	Maximum ebb	2.0	3.0		Maximum ebb	0.0	0.0
2	Low slack	2.3	2.5	9	Low slack	0.0	0.1
	Maximum flood	2.3	1.9		Maximum flood	0.2	0.1
	High slack	2.3	2.1		High slack	0.2	0.1
	Maximum ebb	2.1	2.3		Maximum ebb	0.1	0.1
3	Low slack	0.7	0.8	10	Low slack	0.0	0.0
	Maximum flood	2.4	0.5		Maximum flood	0.1	0.0
	High slack	2.5	0.9		High slack	0.1	0.0
	Maximum ebb	1.5	1.1		Maximum ebb	0.0	0.0
4	Low slack	0.0	0.2	11	Low slack	0.0	0.0
	Maximum flood	0.8	0.5		Maximum flood	0.0	0.0
	High slack	1.0	0.7		High slack	0.0	0.0
	Maximum ebb	0.0	0.1		Maximum ebb	0.0	0.0
5	Low slack	0.5	1.3	12	Low slack	0.1	0.0
	Maximum flood	0.4	0.5		Maximum flood	0.6	0.8
	High slack	0.7	1.2		High slack	0.6	0.7
	Maximum ebb	0.6	1.0		Maximum ebb	0.2	0.2
6	Low slack	0.3	0.1	13	Low slack	0.2	0.1
	Maximum flood	0.9	0.4		Maximum flood	1.7	1.3
	High slack	1.1	1.1		High slack	1.7	1.9
	Maximum ebb	0.6	0.1		Maximum ebb	0.5	0.4
7	Low slack	0.0	0.0				
	Maximum flood	0.0	0.0				
	High slack	0.0	0.0				
	Maximum ebb	0.0	0.0				

Table 19

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 5 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	4.5	4.4
	Maximum flood	4.8	4.0
	High slack	5.1	5.3
	Maximum ebb	5.3	4.3
2	Low slack	5.2	4.5
	Maximum flood	5.1	3.6
	High slack	5.3	4.3
	Maximum ebb	5.5	6.7
3	Low slack	0.6	1.2
	Maximum flood	3.3	2.0
	High slack	3.1	1.4
	Maximum ebb	1.4	2.3
4	Low slack	0.0	1.2
	Maximum flood	3.3	2.0
	High slack	3.1	1.4
	Maximum ebb	1.4	2.3
5	Low slack	3.7	2.3
	Maximum flood	2.3	3.0
	High slack	4.9	4.5
	Maximum ebb	4.6	4.6
6	Low slack	0.5	0.1
	Maximum flood	2.0	1.4
	High slack	2.0	1.6
	Maximum ebb	1.1	0.8
7	Low slack	0.0	0.0
	Maximum flood	0.1	0.1
	High slack	0.1	0.1
	Maximum ebb	0.0	0.0
8	Low slack	0.0	0.0
	Maximum flood	0.0	0.0
	High slack	0.0	0.0
	Maximum ebb	0.0	0.0
9	Low slack	0.0	0.1
	Maximum flood	0.3	0.1
	High slack	0.3	0.2
	Maximum ebb	0.1	0.1
10	Low slack	0.0	0.0
	Maximum flood	0.2	0.0
	High slack	0.1	0.0
	Maximum ebb	0.0	0.0
11	Low slack	0.0	0.0
	Maximum flood	0.0	0.0
	High slack	0.0	0.0
	Maximum ebb	0.0	0.0
12	Low slack	0.1	0.0
	Maximum flood	1.0	1.1
	High slack	1.7	2.1
	Maximum ebb	0.5	0.9
13	Low slack	0.4	0.1
	Maximum flood	2.1	1.4
	High slack	1.7	2.1
	Maximum ebb	0.5	0.9

Table 20

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 8 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	5.0	5.4	8	Low slack	0.0	0.0
	Maximum flood	4.4	4.3		Maximum flood	0.1	0.1
	High slack	4.7	5.2		High slack	0.1	0.1
	Maximum ebb	4.9	6.1		Maximum ebb	0.0	0.0
2	Low slack	5.2	4.3	9	Low slack	0.0	0.2
	Maximum flood	5.1	4.1		Maximum flood	0.4	0.2
	High slack	5.5	4.2		High slack	0.4	0.3
	Maximum ebb	6.5	5.8		Maximum ebb	0.1	0.1
3	Low slack	0.9	0.8	10	Low slack	0.0	0.2
	Maximum flood	3.1	1.7		Maximum flood	0.2	0.0
	High slack	3.3	2.5		High slack	0.2	0.1
	Maximum ebb	1.6	1.9		Maximum ebb	0.1	0.0
4	Low slack	0.0	0.4	11	Low slack	0.0	0.0
	Maximum flood	1.3	0.7		Maximum flood	0.1	0.0
	High slack	1.6	1.1		High slack	0.1	0.0
	Maximum ebb	0.1	0.3		Maximum ebb	0.1	0.0
5	Low slack	3.6	2.5	12	Low slack	0.2	0.1
	Maximum flood	3.5	3.2		Maximum flood	1.7	0.9
	High slack	3.7	4.0		High slack	2.0	1.8
	Maximum ebb	3.3	3.3		Maximum ebb	0.5	0.6
6	Low slack	0.6	0.2	13	Low slack	0.4	0.2
	Maximum flood	3.1	2.5		Maximum flood	2.2	1.2
	High slack	3.4	2.4		High slack	1.8	1.7
	Maximum ebb	1.3	0.8		Maximum ebb	1.2	0.8
7	Low slack	0.0	0.0				
	Maximum flood	0.1	0.3				
	High slack	0.2	0.2				
	Maximum ebb	0.0	0.0				

Table 21

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 8 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	4.8	7.4	8	Low slack	0.0	0.0
	Maximum flood	4.5	5.9		Maximum flood	0.1	0.1
	High slack	3.9	4.5		High slack	0.1	0.2
	Maximum ebb	4.7	7.0		Maximum ebb	0.1	0.0
2	Low slack	6.2	5.1	9	Low slack	0.0	0.3
	Maximum flood	8.8	5.9		Maximum flood	0.5	0.4
	High slack	9.3	6.4		High slack	0.5	0.4
	Maximum ebb	8.0	9.4		Maximum ebb	0.1	0.1
3	Low slack	0.9	1.7	10	Low slack	0.0	0.3
	Maximum flood	3.3	4.0		Maximum flood	0.2	0.1
	High slack	3.7	5.0		High slack	0.2	0.1
	Maximum ebb	1.4	2.7		Maximum ebb	0.1	0.0
4	Low slack	0.0	0.6	11	Low slack	0.0	0.0
	Maximum flood	1.4	1.9		Maximum flood	0.1	0.0
	High slack	1.9	2.2		High slack	0.1	0.1
	Maximum ebb	0.2	0.6		Maximum ebb	0.1	0.1
5	Low slack	3.0	3.5	12	Low slack	0.2	0.1
	Maximum flood	6.5	5.8		Maximum flood	1.8	0.9
	High slack	7.1	8.7		High slack	1.6	1.4
	Maximum ebb	5.0	5.1		Maximum ebb	0.6	0.6
6	Low slack	1.2	0.8	13	Low slack	0.5	0.2
	Maximum flood	2.7	0.4		Maximum flood	2.3	1.6
	High slack	2.8	3.3		High slack	2.4	2.7
	Maximum ebb	1.8	2.0		Maximum ebb	1.5	1.3
7	Low slack	0.0	0.1				
	Maximum flood	0.2	0.2				
	High slack	0.2	0.4				
	Maximum ebb	0.1	0.1				

Table 22

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 5 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	1.8	2.1	8	Low slack	0.0	0.0
	Maximum flood	2.5	2.7		Maximum flood	0.0	0.0
	High slack	2.8	2.8		High slack	0.0	0.0
	Maximum ebb	2.3	2.9		Maximum ebb	0.0	0.0
2	Low slack	2.6	2.0	9	Low slack	0.0	0.1
	Maximum flood	2.6	2.4		Maximum flood	0.1	0.1
	High slack	2.9	3.1		High slack	0.2	0.2
	Maximum ebb	2.9	2.7		Maximum ebb	0.1	0.1
3	Low slack	0.4	0.5	10	Low slack	0.0	0.0
	Maximum flood	2.5	0.5		Maximum flood	0.2	0.2
	High slack	2.0	0.7		High slack	0.2	0.1
	Maximum ebb	1.0	0.4		Maximum ebb	0.0	0.0
4	Low slack	0.0	0.1	11	Low slack	0.0	0.0
	Maximum flood	1.2	0.4		Maximum flood	0.0	0.0
	High slack	0.9	0.6		High slack	0.0	0.0
	Maximum ebb	0.0	0.1		Maximum ebb	0.0	0.1
5	Low slack	0.9	1.6	12	Low slack	0.1	0.0
	Maximum flood	1.6	1.1		Maximum flood	0.6	0.8
	High slack	1.5	1.7		High slack	0.7	0.9
	Maximum ebb	1.4	1.0		Maximum ebb	0.2	0.1
6	Low slack	0.4	0.1	13	Low slack	0.1	0.1
	Maximum flood	2.6	1.0		Maximum flood	1.6	1.2
	High slack	2.6	1.4		High slack	2.6	2.3
	Maximum ebb	0.8	0.1		Maximum ebb	0.2	0.4
7	Low slack	0.0	0.0				
	Maximum flood	0.1	0.1				
	High slack	0.1	0.1				
	Maximum ebb	0.0	0.0				

Table 23

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 5 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	2.6	1.9	8	Low slack	0.0	0.0
	Maximum flood	3.9	3.3		Maximum flood	0.0	0.0
	High slack	4.0	4.3		High slack	0.1	0.0
	Maximum ebb	3.9	2.8		Maximum ebb	0.0	0.0
2	Low slack	3.2	2.6	9	Low slack	0.0	0.1
	Maximum flood	4.6	4.0		Maximum flood	0.2	0.1
	High slack	4.6	4.7		High slack	0.2	0.2
	Maximum ebb	4.2	3.9		Maximum ebb	0.1	0.1
3	Low slack	4.9	0.7	10	Low slack	0.0	0.0
	Maximum flood	2.7	1.0		Maximum flood	0.2	0.0
	High slack	2.6	1.1		High slack	0.2	0.1
	Maximum ebb	1.0	0.4		Maximum ebb	0.0	0.0
4	Low slack	0.0	0.2	11	Low slack	0.0	0.0
	Maximum flood	1.0	0.9		Maximum flood	0.0	0.0
	High slack	0.8	0.8		High slack	0.1	0.0
	Maximum ebb	0.0	0.2		Maximum ebb	0.1	0.0
5	Low slack	2.1	1.6	12	Low slack	0.1	0.1
	Maximum flood	4.1	1.2		Maximum flood	0.8	1.3
	High slack	4.3	2.7		High slack	0.8	1.1
	Maximum ebb	2.6	1.7		Maximum ebb	0.2	0.1
6	Low slack	0.5	0.1	13	Low slack	0.2	0.0
	Maximum flood	1.8	1.7		Maximum flood	1.0	0.7
	High slack	1.8	2.0		High slack	1.3	1.2
	Maximum ebb	0.6	0.6		Maximum ebb	0.2	0.4
7	Low slack	0.0	0.1				
	Maximum flood	0.1	0.1				
	High slack	0.1	0.2				
	Maximum ebb	0.0	0.1				

Table 24

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 8 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	2.6	2.9	8	Low slack	0.0	0.0
	Maximum flood	2.5	2.5		Maximum flood	0.0	0.0
	High slack	2.8	2.6		High slack	0.0	0.1
	Maximum ebb	2.8	2.6		Maximum ebb	0.0	0.0
2	Low slack	2.7	1.7	9	Low slack	0.0	0.2
	Maximum flood	3.0	2.3		Maximum flood	0.2	0.1
	High slack	3.2	2.8		High slack	0.3	0.2
	Maximum ebb	2.4	1.0		Maximum ebb	0.1	0.1
3	Low slack	0.7	0.8	10	Low slack	0.0	0.1
	Maximum flood	4.2	0.6		Maximum flood	0.1	0.0
	High slack	4.7	1.3		High slack	0.1	0.1
	Maximum ebb	1.2	1.2		Maximum ebb	0.0	0.0
4	Low slack	0.0	0.3	11	Low slack	0.0	0.0
	Maximum flood	0.9	0.9		Maximum flood	0.1	0.0
	High slack	0.8	0.9		High slack	0.1	0.0
	Maximum ebb	0.0	0.2		Maximum ebb	0.0	0.1
5	Low slack	2.1	2.2	12	Low slack	0.1	0.1
	Maximum flood	1.6	1.8		Maximum flood	0.8	1.0
	High slack	1.9	1.6		High slack	0.7	1.3
	Maximum ebb	1.6	2.6		Maximum ebb	0.3	0.2
6	Low slack	0.7	0.3	13	Low slack	0.2	0.1
	Maximum flood	2.1	1.9		Maximum flood	2.6	1.6
	High slack	1.9	1.5		High slack	2.5	2.1
	Maximum ebb	0.9	0.9		Maximum ebb	0.4	0.8
7	Low slack	0.0	0.1				
	Maximum flood	0.1	0.2				
	High slack	0.1	0.3				
	Maximum ebb	0.0	0.0				

Table 25

Plan 1B Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 8 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Gage No.	Flow Condition	Base	Plan 1B
1	Low slack	4.8	4.0	8	Low slack	0.0	0.0
	Maximum flood	4.6	4.5		Maximum flood	0.0	0.1
	High slack	4.4	4.3		High slack	0.0	0.2
	Maximum ebb	4.3	3.8		Maximum ebb	0.0	0.0
2	Low slack	3.8	4.1	9	Low slack	0.0	0.2
	Maximum flood	6.2	5.5		Maximum flood	0.3	0.1
	High slack	5.9	6.2		High slack	0.3	0.4
	Maximum ebb	5.5	3.1		Maximum ebb	0.1	0.1
3	Low slack	1.0	1.0	10	Low slack	0.0	0.1
	Maximum flood	3.6	2.1		Maximum flood	0.2	0.0
	High slack	3.6	2.8		High slack	0.2	0.1
	Maximum ebb	1.2	2.1		Maximum ebb	0.0	0.0
4	Low slack	0.0	0.4	11	Low slack	0.0	0.0
	Maximum flood	1.0	1.5		Maximum flood	0.1	0.0
	High slack	1.1	1.9		High slack	0.1	0.0
	Maximum ebb	0.0	0.4		Maximum ebb	0.0	0.1
5	Low slack	3.1	3.1	12	Low slack	0.1	0.1
	Maximum flood	3.7	2.5		Maximum flood	0.9	1.5
	High slack	4.2	3.0		High slack	0.8	1.7
	Maximum ebb	3.9	4.1		Maximum ebb	0.3	0.4
6	Low slack	0.8	0.3	13	Low slack	0.3	0.3
	Maximum flood	1.8	1.7		Maximum flood	1.9	1.9
	High slack	2.2	2.8		High slack	2.5	2.1
	Maximum ebb	1.1	1.1		Maximum ebb	0.6	0.7
7	Low slack	0.0	0.1				
	Maximum flood	0.1	0.3				
	High slack	0.1	0.4				
	Maximum ebb	0.0	--				

Table 26

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 5 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 7A	Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	1.0	*	8	Low slack	0.0	*
	Maximum flood	1.3	1.7		Maximum flood	**	0.0
	High slack	1.6	1.6		High slack	0.0	0.0
	Maximum ebb	1.4	1.9		Maximum ebb	**	0.0
2	Low slack	1.9	*	9	Low slack	0.0	*
	Maximum flood	1.7	0.7		Maximum flood	0.3	0.2
	High slack	2.0	0.9		High slack	0.2	0.1
	Maximum ebb	2.0	0.5		Maximum ebb	0.1	0.1
3	Low slack	0.8	*	10	Low slack	0.0	*
	Maximum flood	2.8	0.4		Maximum flood	0.1	0.0
	High slack	2.4	0.3		High slack	0.1	0.0
	Maximum ebb	0.9	0.2		Maximum ebb	0.0	0.0
4	Low slack	0.1	*	11	Low slack	0.0	*
	Maximum flood	1.2	0.3		Maximum flood	0.0	0.0
	High slack	1.3	0.4		High slack	0.0	0.0
	Maximum ebb	0.1	0.1		Maximum ebb	0.1	0.0
5	Low slack	0.7	*	12	Low slack	0.4	*
	Maximum flood	1.5	1.3		Maximum flood	0.7	1.0
	High slack	1.7	1.0		High slack	0.7	1.1
	Maximum ebb	1.5	0.9		Maximum ebb	0.6	0.4
6	Low slack	0.0	*	13	Low slack	--	--
	Maximum flood	0.7	0.7		Maximum flood	--	--
	High slack	0.7	0.7		High slack	--	--
	Maximum ebb	0.0	0.0		Maximum ebb	--	--
7	Low slack	0.0	*				
	Maximum flood	0.1	0.0				
	High slack	0.1	0.0				
	Maximum ebb	0.0	0.0				

* ADACS failure.

** Gage out of water.

AD-A054 242 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 8/3
IMPROVEMENTS FOR MURRELLS INLET, SOUTH CAROLINA. HYDRAULIC MODE--ETC(U)
APR 78 F C PERRY, W C SEABERGH, E F LANE

UNCLASSIFIED WES-TR-H-78-4 NL

2 OF 4
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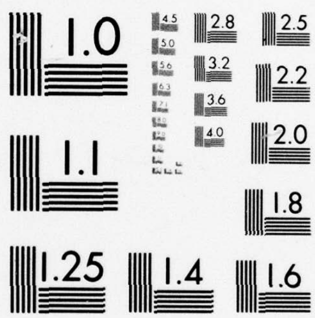
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1.1
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1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6

Table 27

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)
for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 5 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 7A	Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	3.2	2.0	8	Low slack	0.0	0.0
	Maximum flood	4.0	3.4		Maximum flood	0.0	0.0
	High slack	3.6	3.4		High slack	0.1	0.0
	Maximum ebb	3.5	3.0		Maximum ebb	0.0	0.0
2	Low slack	3.4	1.4	9	Low slack	0.0	0.0
	Maximum flood	3.9	1.6		Maximum flood	0.6	0.3
	High slack	4.7	1.9		High slack	0.3	0.2
	Maximum ebb	4.7	1.4		Maximum ebb	0.1	0.1
3	Low slack	0.9	0.9	10	Low slack	0.0	0.0
	Maximum flood	1.9	0.9		Maximum flood	0.2	0.1
	High slack	2.3	0.6		High slack	0.1	0.1
	Maximum ebb	1.0	0.3		Maximum ebb	0.0	0.0
4	Low slack	0.1	0.4	11	Low slack	0.0	0.0
	Maximum flood	1.2	0.6		Maximum flood	0.0	0.1
	High slack	1.0	0.6		High slack	0.1	0.1
	Maximum ebb	0.3	0.1		Maximum ebb	0.1	0.0
5	Low slack	0.9	0.4	12	Low slack	0.5	0.3
	Maximum flood	3.5	3.3		Maximum flood	2.3	2.4
	High slack	3.0	2.7		High slack	2.4	2.5
	Maximum ebb	1.4	1.2		Maximum ebb	1.3	1.1
6	Low slack	0.0	0.0	13	Low slack	0.3	0.1
	Maximum flood	0.8	1.0		Maximum flood	1.8	1.4
	High slack	0.8	1.2		High slack	1.8	1.4
	Maximum ebb	0.1	0.2		Maximum ebb	0.5	0.4
7	Low slack	0.1	0.0				
	Maximum flood	0.1	0.1				
	High slack	0.2	0.0				
	Maximum ebb	0.1	0.0				

Table 28

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 8 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 7A	Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	2.6	1.9	8	Low slack	0.0	0.0
	Maximum flood	2.4	2.6		Maximum flood	0.0	0.0
	High slack	2.4	2.6		High slack	0.0	0.0
	Maximum ebb	2.7	2.2		Maximum ebb	0.0	0.0
2	Low slack	2.9	1.2	9	Low slack	0.0	0.0
	Maximum flood	2.5	1.6		Maximum flood	0.3	0.3
	High slack	2.9	1.8		High slack	0.5	0.3
	Maximum ebb	3.1	1.7		Maximum ebb	0.1	0.1
3	Low slack	1.0	0.4	10	Low slack	0.0	0.0
	Maximum flood	2.3	1.1		Maximum flood	0.1	0.1
	High slack	2.4	1.0		High slack	0.1	0.1
	Maximum ebb	1.9	0.5		Maximum ebb	0.0	0.0
4	Low slack	0.2	0.2	11	Low slack	0.0	0.0
	Maximum flood	1.1	0.7		Maximum flood	0.0	0.1
	High slack	1.3	0.6		High slack	0.1	0.1
	Maximum ebb	0.4	0.3		Maximum ebb	0.0	0.0
5	Low slack	1.3	0.6	12	Low slack	0.8	0.5
	Maximum flood	3.8	3.3		Maximum flood	2.0	2.8
	High slack	4.0	3.8		High slack	2.6	2.3
	Maximum ebb	1.6	1.8		Maximum ebb	1.2	1.2
6	Low slack	0.0	0.0	13	Low slack	0.4	0.0
	Maximum flood	0.9	1.4		Maximum flood	2.5	1.4
	High slack	1.2	1.1		High slack	2.6	1.3
	Maximum ebb	0.1	0.3		Maximum ebb	0.6	0.5
7	Low slack	0.1	0.0				
	Maximum flood	0.1	*				
	High slack	0.3	0.1				
	Maximum ebb	0.0	0.0				

* ADACS failure.

Table 29

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 8 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 7A	Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	4.0	4.0	8	Low slack	0.0	0.0
	Maximum flood	3.3	3.7		Maximum flood	0.0	0.0
	High slack	3.5	4.3		High slack	0.1	0.1
	Maximum ebb	3.7	4.1		Maximum ebb	0.0	0.0
2	Low slack	4.6	3.0	9	Low slack	0.0	0.0
	Maximum flood	3.7	3.2		Maximum flood	0.4	0.4
	High slack	4.8	4.1		High slack	0.5	0.4
	Maximum ebb	5.4	3.0		Maximum ebb	0.1	0.1
3	Low slack	1.3	0.7	10	Low slack	0.0	0.0
	Maximum flood	2.6	1.8		Maximum flood	0.1	0.1
	High slack	2.8	1.9		High slack	0.2	0.1
	Maximum ebb	1.8	1.3		Maximum ebb	0.0	0.0
4	Low slack	0.3	0.3	11	Low slack	0.0	0.0
	Maximum flood	1.9	1.1		Maximum flood	0.0	0.2
	High slack	1.5	1.1		High slack	0.1	0.3
	Maximum ebb	0.5	0.4		Maximum ebb	0.0	0.1
5	Low slack	1.5	0.8	12	Low slack	1.1	0.5
	Maximum flood	3.4	4.3		Maximum flood	4.4	2.8
	High slack	3.2	3.4		High slack	3.1	3.4
	Maximum ebb	1.7	2.1		Maximum ebb	1.8	1.1
6	Low slack	0.0	0.0	13	Low slack	0.6	0.2
	Maximum flood	1.1	1.6		Maximum flood	1.6	1.5
	High slack	1.3	1.6		High slack	1.4	2.4
	Maximum ebb	0.2	0.3		Maximum ebb	0.6	0.4
7	Low slack	0.1	0.0				
	Maximum flood	0.2	0.1				
	High slack	0.4	0.1				
	Maximum ebb	0.1	0.0				

Table 30

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)
for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 5 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 7A	Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	3.4	3.8	8	Low slack	0.0	0.0
	Maximum flood	3.3	3.9		Maximum flood	0.0	0.0
	High slack	3.2	3.7		High slack	0.0	0.1
	Maximum ebb	3.5	3.2		Maximum ebb	0.0	0.0
2	Low slack	2.1	1.3	9	Low slack	0.0	0.0
	Maximum flood	3.0	1.6		Maximum flood	0.2	0.2
	High slack	2.9	2.0		High slack	0.2	0.2
	Maximum ebb	3.9	3.6		Maximum ebb	0.1	0.1
3	Low slack	0.8	0.5	10	Low slack	0.0	0.0
	Maximum flood	2.2	0.6		Maximum flood	0.1	0.1
	High slack	2.3	0.7		High slack	0.1	0.1
	Maximum ebb	1.1	0.9		Maximum ebb	0.0	0.0
4	Low slack	0.1	0.3	11	Low slack	0.0	0.0
	Maximum flood	0.6	0.4		Maximum flood	0.0	0.1
	High slack	0.6	0.4		High slack	0.0	0.1
	Maximum ebb	0.2	0.6		Maximum ebb	0.0	0.1
5	Low slack	0.7	0.2	12	Low slack	0.3	0.1
	Maximum flood	2.4	1.8		Maximum flood	0.9	0.5
	High slack	2.5	2.6		High slack	1.1	0.8
	Maximum ebb	1.5	1.1		Maximum ebb	0.6	0.5
6	Low slack	0.0	0.0	13	Low slack	0.2	0.1
	Maximum flood	0.6	0.9		Maximum flood	1.7	1.7
	High slack	1.0	1.2		High slack	1.7	1.6
	Maximum ebb	0.1	0.2		Maximum ebb	0.5	0.4
7	Low slack	0.0	0.0				
	Maximum flood	0.0	0.1				
	High slack	0.1	0.1				
	Maximum ebb	0.0	0.0				

Table 31

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 5 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	6.3	8.1
	Maximum flood	5.4	6.1
	High slack	5.8	5.9
	Maximum ebb	6.2	2.5
2	Low slack	6.0	3.4
	Maximum flood	5.5	3.7
	High slack	5.8	4.2
	Maximum ebb	5.4	3.3
3	Low slack	1.3	1.3
	Maximum flood	2.0	1.1
	High slack	2.2	1.4
	Maximum ebb	1.1	1.8
4	Low slack	0.1	0.6
	Maximum flood	1.0	0.8
	High slack	1.2	0.5
	Maximum ebb	0.3	0.8
5	Low slack	0.6	0.4
	Maximum flood	3.3	3.5
	High slack	3.1	4.0
	Maximum ebb	1.4	1.5
6	Low slack	0.0	0.1
	Maximum flood	1.0	*
	High slack	1.0	1.1
	Maximum ebb	0.2	0.2
7	Low slack	0.0	0.0
	Maximum flood	0.1	0.1
	High slack	0.2	0.1
	Maximum ebb	0.0	0.0
8	Low slack	0.0	0.0
	Maximum flood	0.0	0.1
	High slack	0.0	0.1
	Maximum ebb	0.0	0.0
9	Low slack	0.0	0.6
	Maximum flood	0.3	0.2
	High slack	0.3	0.2
	Maximum ebb	0.1	0.1
10	Low slack	0.0	0.0
	Maximum flood	0.2	0.1
	High slack	0.1	0.1
	Maximum ebb	0.0	0.0
11	Low slack	0.0	0.1
	Maximum flood	0.0	0.1
	High slack	0.0	0.1
	Maximum ebb	0.0	0.0
12	Low slack	0.5	0.2
	Maximum flood	2.0	2.5
	High slack	2.0	2.3
	Maximum ebb	1.1	1.1
13	Low slack	0.4	0.2
	Maximum flood	2.1	1.9
	High slack	1.7	1.9
	Maximum ebb	0.5	0.7

* ADACS failure.

Table 32

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 8 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	6.3	4.4
	Maximum flood	7.1	7.2
	High slack	7.3	7.1
	Maximum ebb	6.8	6.4
2	Low slack	6.1	2.4
	Maximum flood	6.9	3.2
	High slack	7.0	3.3
	Maximum ebb	6.0	4.1
3	Low slack	1.8	0.8
	Maximum flood	2.3	1.9
	High slack	2.3	3.0
	Maximum ebb	1.5	1.2
4	Low slack	0.2	0.3
	Maximum flood	1.7	1.6
	High slack	2.0	1.2
	Maximum ebb	0.5	0.8
5	Low slack	0.9	0.4
	Maximum flood	3.1	3.1
	High slack	3.3	2.9
	Maximum ebb	1.6	1.5
6	Low slack	0.0	0.1
	Maximum flood	1.4	1.7
	High slack	1.4	1.8
	Maximum ebb	0.3	0.2
7	Low slack	0.1	0.0
	Maximum flood	0.1	0.1
	High slack	0.3	0.1
	Maximum ebb	0.1	0.1

Gage No.	Flow Condition	Base	Plan 7A
8	Low slack	0.0	0.0
	Maximum flood	0.1	0.1
	High slack	0.1	0.1
	Maximum ebb	0.0	0.1
9	Low slack	0.0	0.0
	Maximum flood	0.4	0.3
	High slack	0.4	0.3
	Maximum ebb	0.1	0.1
10	Low slack	0.0	0.0
	Maximum flood	0.2	0.1
	High slack	0.2	0.1
	Maximum ebb	0.1	0.0
11	Low slack	0.0	0.1
	Maximum flood	0.1	0.1
	High slack	0.1	0.2
	Maximum ebb	0.1	0.0
12	Low slack	0.6	0.3
	Maximum flood	3.1	2.5
	High slack	3.4	2.7
	Maximum ebb	1.3	1.0
13	Low slack	0.4	0.1
	Maximum flood	2.2	2.1
	High slack	1.8	2.4
	Maximum ebb	1.2	0.6

Table 33

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 8 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 7A	Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	9.8	7.9	8	Low slack	0.0	0.0
	Maximum flood	10.1	11.7		Maximum flood	0.1	0.1
	High slack	10.2	11.7		High slack	0.1	0.1
	Maximum ebb	9.9	11.9		Maximum ebb	0.1	0.1
2	Low slack	7.5	6.3	9	Low slack	0.0	0.0
	Maximum flood	11.1	6.7		Maximum flood	0.5	0.3
	High slack	11.2	6.8		High slack	0.5	0.3
	Maximum ebb	9.5	8.8		Maximum ebb	0.1	0.2
3	Low slack	1.3	2.0	10	Low slack	0.0	0.0
	Maximum flood	2.4	4.9		Maximum flood	0.2	*
	High slack	2.5	5.8		High slack	0.2	0.1
	Maximum ebb	1.8	3.9		Maximum ebb	0.1	0.1
4	Low slack	0.2	0.8	11	Low slack	0.0	0.1
	Maximum flood	1.8	2.9		Maximum flood	0.1	0.2
	High slack	1.6	2.2		High slack	0.1	0.3
	Maximum ebb	0.6	1.3		Maximum ebb	0.1	0.1
5	Low slack	0.9	0.5	12	Low slack	1.2	0.5
	Maximum flood	3.3	3.4		Maximum flood	2.7	2.1
	High slack	3.7	3.4		High slack	2.8	2.2
	Maximum ebb	1.4	1.3		Maximum ebb	1.8	1.1
6	Low slack	0.0	0.2	13	Low slack	0.5	0.3
	Maximum flood	1.3	2.0		Maximum flood	2.3	1.7
	High slack	1.5	2.0		High slack	2.4	1.8
	Maximum ebb	0.4	0.6		Maximum ebb	1.5	1.1
7	Low slack	0.1	0.0				
	Maximum flood	0.2	0.1				
	High slack	0.3	0.2				
	Maximum ebb	0.1	0.1				

* ADACS failure.

Table 34

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 5 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 7A	Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	2.0	2.3	8	Low slack	0.0	0.0
	Maximum flood	1.8	2.4		Maximum flood	0.0	0.0
	High slack	2.2	2.7		High slack	0.0	0.0
	Maximum ebb	2.2	2.7		Maximum ebb	0.0	0.0
2	Low slack	3.1	1.1	9	Low slack	0.0	0.0
	Maximum flood	2.5	1.0		Maximum flood	0.1	0.1
	High slack	2.4	1.5		High slack	0.2	0.0
	Maximum ebb	2.5	1.4		Maximum ebb	0.1	0.1
3	Low slack	*	0.3	10	Low slack	0.0	0.0
	Maximum flood	1.5	0.8		Maximum flood	0.2	0.0
	High slack	1.2	0.8		High slack	0.2	0.0
	Maximum ebb	1.0	0.4		Maximum ebb	0.0	0.0
4	Low slack	0.1	0.2	11	Low slack	0.0	0.0
	Maximum flood	0.6	0.3		Maximum flood	0.0	0.0
	High slack	0.7	0.6		High slack	0.0	0.0
	Maximum ebb	0.2	0.2		Maximum ebb	0.0	0.0
5	Low slack	0.4	0.1	12	Low slack	0.4	0.1
	Maximum flood	2.5	1.6		Maximum flood	2.6	2.3
	High slack	2.0	1.6		High slack	2.6	2.5
	Maximum ebb	1.0	0.9		Maximum ebb	0.8	0.8
6	Low slack	0.0	0.0	13	Low slack	0.1	0.1
	Maximum flood	0.6	0.4		Maximum flood	1.6	2.0
	High slack	0.7	0.3		High slack	2.6	1.9
	Maximum ebb	0.0	0.1		Maximum ebb	0.2	0.3
7	Low slack	0.0	0.0				
	Maximum flood	0.1	0.0				
	High slack	0.2	0.0				
	Maximum ebb	0.0	0.0				

* Gage out of water.

Table 35

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 5 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 7A	Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	3.3	3.8	8	Low slack	0.0	0.0
	Maximum flood	3.9	3.4		Maximum flood	0.0	0.0
	High slack	3.9	3.4		High slack	0.1	0.0
	Maximum ebb	3.5	3.8		Maximum ebb	0.0	0.0
2	Low slack	4.1	1.8	9	Low slack	0.0	0.0
	Maximum flood	3.5	1.6		Maximum flood	0.2	0.1
	High slack	3.7	2.1		High slack	0.2	0.1
	Maximum ebb	3.5	1.8		Maximum ebb	0.1	0.1
3	Low slack	*	0.6	10	Low slack	0.0	0.0
	Maximum flood	3.4	1.2		Maximum flood	0.2	0.0
	High slack	2.9	1.1		High slack	0.2	0.0
	Maximum ebb	1.0	0.5		Maximum ebb	0.0	0.0
4	Low slack	0.1	0.2	11	Low slack	0.0	0.0
	Maximum flood	0.8	0.5		Maximum flood	0.0	0.0
	High slack	0.8	0.8		High slack	0.1	0.0
	Maximum ebb	0.2	0.3		Maximum ebb	0.1	0.0
5	Low slack	4.9	0.2	12	Low slack	0.5	0.1
	Maximum flood	2.7	2.1		Maximum flood	1.8	2.1
	High slack	2.6	2.3		High slack	1.8	1.8
	Maximum ebb	1.0	1.1		Maximum ebb	0.6	0.6
6	Low slack	0.0	0.0	13	Low slack	0.2	0.1
	Maximum flood	0.9	0.5		Maximum flood	1.0	1.7
	High slack	0.9	0.5		High slack	1.3	2.0
	Maximum ebb	0.1	0.1		Maximum ebb	0.2	0.4
7	Low slack	0.0	0.0				
	Maximum flood	0.1	0.0				
	High slack	0.2	0.0				
	Maximum ebb	0.0	0.0				

* Gage out of water.

Table 36

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 8 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 7A	Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	1.6	2.7	8	Low slack	0.0	0.0
	Maximum flood	2.3	2.1		Maximum flood	0.0	0.0
	High slack	2.5	2.2		High slack	0.0	0.0
	Maximum ebb	1.9	2.1		Maximum ebb	0.0	0.0
2	Low slack	2.5	2.1	9	Low slack	0.0	0.0
	Maximum flood	2.7	1.6		Maximum flood	0.2	0.2
	High slack	2.9	1.8		High slack	0.3	0.2
	Maximum ebb	2.5	2.1		Maximum ebb	0.1	0.1
3	Low slack	*	0.7	10	Low slack	0.0	0.0
	Maximum flood	2.1	1.0		Maximum flood	0.1	0.0
	High slack	2.2	1.2		High slack	0.1	0.0
	Maximum ebb	1.3	0.8		Maximum ebb	0.0	0.0
4	Low slack	0.1	0.4	11	Low slack	0.0	0.0
	Maximum flood	0.8	0.6		Maximum flood	0.1	0.1
	High slack	0.7	0.6		High slack	0.1	0.1
	Maximum ebb	0.3	0.3		Maximum ebb	0.0	0.0
5	Low slack	0.7	0.4	12	Low slack	0.7	0.2
	Maximum flood	4.2	2.9		Maximum flood	2.1	2.9
	High slack	4.7	2.8		High slack	1.9	3.4
	Maximum ebb	1.2	1.4		Maximum ebb	0.9	0.8
6	Low slack	0.0	0.0	13	Low slack	0.2	0.3
	Maximum flood	1.3	0.7		Maximum flood	2.6	2.2
	High slack	1.5	0.8		High slack	2.5	2.2
	Maximum ebb	0.0	0.2		Maximum ebb	0.4	0.9
7	Low slack	0.0	0.0				
	Maximum flood	0.1	0.1				
	High slack	0.3	0.0				
	Maximum ebb	0.0	0.0				

* Gage out of water.

Table 37

Plan 7A Wave Tests

Comparison of Significant Wave Heights (ft)

for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 8 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 7A	Gage No.	Flow Condition	Base	Plan 7A
1	Low slack	2.5	4.0	8	Low slack	0.0	0.0
	Maximum flood	4.3	4.4		Maximum flood	0.0	0.0
	High slack	4.3	4.2		High slack	0.0	0.0
	Maximum ebb	3.3	3.0		Maximum ebb	0.0	0.0
2	Low slack	4.1	3.3	9	Low slack	0.0	0.0
	Maximum flood	4.5	2.5		Maximum flood	0.3	0.3
	High slack	4.7	3.0		High slack	0.3	0.2
	Maximum ebb	4.5	2.8		Maximum ebb	0.1	0.1
3	Low slack	*	1.1	10	Low slack	0.0	0.0
	Maximum flood	3.2	1.7		Maximum flood	0.2	0.0
	High slack	3.2	1.6		High slack	0.2	0.1
	Maximum ebb	1.1	1.0		Maximum ebb	0.0	0.0
4	Low slack	0.1	0.6	11	Low slack	0.0	0.0
	Maximum flood	0.9	1.0		Maximum flood	0.1	0.1
	High slack	0.8	1.2		High slack	0.1	0.2
	Maximum ebb	0.3	0.5		Maximum ebb	0.0	0.0
5	Low slack	1.0	0.5	12	Low slack	0.8	0.4
	Maximum flood	3.6	3.4		Maximum flood	1.8	3.0
	High slack	3.6	3.4		High slack	2.2	2.7
	Maximum ebb	1.2	1.4		Maximum ebb	1.1	0.8
6	Low slack	0.0	0.1	13	Low slack	0.3	0.2
	Maximum flood	1.8	1.2		Maximum flood	1.9	2.1
	High slack	1.4	1.2		High slack	2.5	2.0
	Maximum ebb	0.1	0.2		Maximum ebb	0.6	0.7
7	Low slack	0.0	0.0				
	Maximum flood	0.2	0.0				
	High slack	0.2	0.1				
	Maximum ebb	0.0	0.0				

* Gage out of water.

Table 38

Plan 1D Tide Tests

Comparison of Tidal Amplitudes of the Principal Lunar Constituents (ft)

Gage	Base II	Plan 1D	Difference		
			1D	1B	1C
1	1.72	1.77	+0.05	+0.03	+0.03
2	1.79	1.91	+0.12	+0.07	+0.07
3	1.80	1.95	+0.15	+0.07	+0.07
4	1.88	2.25	+0.35	+0.37	+0.39
5	1.84	2.01	+0.17	+0.13	+0.14
6	1.87	2.19	+0.32	+0.33	+0.35
7	1.82	1.87	+0.05	+0.07	+0.08
8	2.40	2.41	+0.01	0.00	+0.03

Table 39

Plan 1D Tide Tests

Comparison of Mean Tide Levels of the Principal Lunar Constituent (ft mlw)

Gage	Base II	Plan 1D	Difference		
			1D	1B	1C
1	2.73	2.77	+0.04	-0.01	+0.01
2	2.70	2.67	-0.03	-0.03	-0.01
3	2.55	2.61	+0.06	-0.02	-0.01
4	2.66	2.48	-0.18	-0.25	-0.26
5	2.68	2.65	-0.03	-0.07	-0.08
6	2.66	2.52	-0.14	-0.20	-0.22
7	2.76	2.79	+0.03	-0.04	-0.04
8	2.37	2.38	+0.01	-0.03	0.04

Table 41

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 5 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D	Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	1.6	2.1	2.5	8	Low slack	0.0	0.0	0.0
	Maximum flood	2.1	1.7	2.9		Maximum flood	*	0.0	0.0
	High slack	2.2	3.0	2.4		High slack	0.0	0.0	0.0
	Maximum ebb	1.5	2.2	1.5		Maximum ebb	*	0.0	0.0
2	Low slack	1.9	2.0	1.4	9	Low slack	0.0	0.1	0.1
	Maximum flood	2.0	1.9	1.2		Maximum flood	0.3	0.1	0.1
	High slack	2.3	2.3	1.7		High slack	0.2	0.1	0.1
	Maximum ebb	2.2	2.5	2.0		Maximum ebb	0.1	0.1	0.0
3	Low slack	0.7	0.6	0.4	10	Low slack	0.0	0.0	0.0
	Maximum flood	1.5	1.1	0.7		Maximum flood	0.1	0.0	0.0
	High slack	1.7	0.9	0.7		High slack	0.1	0.0	0.0
	Maximum ebb	1.5	1.2	0.3		Maximum ebb	0.0	0.0	0.0
4	Low slack	0.0	0.2	0.2	11	Low slack	0.0	0.0	0.0
	Maximum flood	0.7	0.9	0.5		Maximum flood	0.0	0.0	0.0
	High slack	0.6	0.7	0.4		High slack	0.0	0.0	0.0
	Maximum ebb	0.0	0.2	0.0		Maximum ebb	0.1	0.1	0.1
5	Low slack	1.9	1.8	3.4	12	Low slack	0.1	0.0	0.1
	Maximum flood	1.7	1.2	2.1		Maximum flood	1.2	1.1	1.4
	High slack	1.8	1.0	2.0		High slack	1.3	1.2	1.5
	Maximum ebb	1.6	1.7	3.2		Maximum ebb	0.1	0.3	0.2
6	Low slack	0.4	0.1	0.1	13	Low slack	0.2	0.1	0.1
	Maximum flood	0.7	1.4	1.1		Maximum flood	1.4	0.7	1.2
	High slack	0.7	1.0	0.9		High slack	1.4	1.0	1.3
	Maximum ebb	0.6	0.3	0.3		Maximum ebb	0.5	0.2	0.2
7	Low slack	0.0	0.0	0.0					
	Maximum flood	0.1	0.0	0.1					
	High slack	0.1	0.0	0.1					
	Maximum ebb	0.0	0.0	0.0					

* ADACS failure.

Table 40

Plan 1D Tide Tests

Comparison of Phase Differences of the Principal Lunar Constituents (deg*)

Gage to Gage	Base II	Plan 1D	Difference 1D	1B	1C
8-1	49.2	48.7	-0.5	+0.65	+1.05
8-2	34.2	31.8	-2.4	-1.20	-1.50
8-3	20.2	19.5	-0.7	+1.90	+1.40
8-4	20.3	14.0	-6.3	-8.10	-8.70
8-5	33.1	28.4	-4.7	-5.70	-5.70
8-6	32.5	25.4	-7.1	-9.40	-9.50
8-7	46.8	44.7	-2.1	-4.78	-3.82

* 1 degree of phase lag equals 2.07 minutes of prototype time.

Table 42

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 5 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D	Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	*	5.1	4.1	8	Low slack	0.0	0.0	0.0
	Maximum flood	5.5	5.2	4.3		Maximum flood	0.0	0.0	0.0
	High slack	5.9	5.9	4.1		High slack	0.1	0.0	0.1
	Maximum ebb	5.4	5.3	5.6		Maximum ebb	0.0	0.0	0.0
2	Low slack	4.3	3.7	2.4	9	Low slack	0.0	0.1	0.1
	Maximum flood	4.5	3.1	2.3		Maximum flood	0.6	0.2	0.2
	High slack	4.1	3.6	3.0		High slack	0.3	0.2	0.1
	Maximum ebb	5.0	3.8	5.3		Maximum ebb	0.1	0.1	0.0
3	Low slack	0.9	1.0	0.5	10	Low slack	0.0	0.0	0.0
	Maximum flood	3.5	1.5	1.2		Maximum flood	0.2	0.1	0.1
	High slack	3.0	1.5	1.2		High slack	0.1	0.1	0.1
	Maximum ebb	1.4	2.1	0.5		Maximum ebb	0.0	0.0	0.0
4	Low slack	0.0	0.3	0.3	11	Low slack	0.0	0.0	0.0
	Maximum flood	1.4	1.1	0.8		Maximum flood	0.0	0.0	0.0
	High slack	1.0	1.2	0.6		High slack	0.1	0.0	0.0
	Maximum ebb	0.0	0.5	0.1		Maximum ebb	0.1	0.1	0.1
5	Low slack	2.9	2.8	3.7	12	Low slack	0.1	0.0	0.1
	Maximum flood	4.8	4.3	4.5		Maximum flood	1.2	0.7	1.2
	High slack	5.3	3.7	4.7		High slack	1.0	1.1	1.3
	Maximum ebb	3.9	5.1	5.3		Maximum ebb	0.3	0.3	0.3
6	Low slack	0.5	0.3	0.3	13	Low slack	0.3	0.1	0.1
	Maximum flood	2.3	2.1	1.9		Maximum flood	1.8	1.4	1.2
	High slack	2.4	2.5	2.1		High slack	1.8	1.4	1.5
	Maximum ebb	1.3	1.2	1.5		Maximum ebb	0.5	0.6	0.2
7	Low slack	0.0	0.0	0.1					
	Maximum flood	0.1	0.1	0.4					
	High slack	0.1	0.1	0.3					
	Maximum ebb	0.0	0.1	0.1					

* Gage out of water.

Table 43

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 8 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D	Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	*	4.0	3.1	8	Low slack	0.0	0.0	0.0
	Maximum flood	4.3	4.2	4.5		Maximum flood	0.0	0.1	0.0
	High slack	4.5	5.1	4.3		High slack	0.0	0.1	0.1
	Maximum ebb	4.1	3.7	1.7		Maximum ebb	0.0	0.0	0.0
2	Low slack	1.9	2.7	3.5	9	Low slack	0.0	0.2	0.2
	Maximum flood	1.7	1.6	1.8		Maximum flood	0.3	0.2	0.3
	High slack	2.0	1.9	2.2		High slack	0.5	0.3	0.4
	Maximum ebb	1.5	2.9	5.0		Maximum ebb	0.1	0.1	0.1
3	Low slack	1.3	0.7	0.7	10	Low slack	0.0	0.1	0.2
	Maximum flood	3.8	1.5	1.1		Maximum flood	0.1	0.0	0.1
	High slack	4.0	1.6	1.4		High slack	0.1	0.1	0.2
	Maximum ebb	1.6	1.3	0.7		Maximum ebb	0.0	0.0	0.1
4	Low slack	0.0	0.3	0.4	11	Low slack	0.0	0.0	**
	Maximum flood	1.3	0.9	1.3		Maximum flood	0.0	0.0	0.0
	High slack	1.0	1.5	1.5		High slack	0.1	0.0	0.0
	Maximum ebb	0.0	0.2	0.2		Maximum ebb	0.0	0.1	**
5	Low slack	3.2	2.8	4.0	12	Low slack	0.2	0.0	0.2
	Maximum flood	2.9	3.8	3.4		Maximum flood	1.1	0.6	1.8
	High slack	3.0	2.7	3.6		High slack	1.3	1.3	1.6
	Maximum ebb	2.9	3.3	3.4		Maximum ebb	0.4	0.5	0.3
6	Low slack	0.8	0.1	0.6	13	Low slack	0.4	0.1	0.1
	Maximum flood	2.0	2.4	2.6		Maximum flood	2.5	1.6	1.6
	High slack	2.6	1.5	2.6		High slack	2.6	2.1	2.0
	Maximum ebb	1.2	0.6	0.9		Maximum ebb	0.6	0.8	0.2
7	Low slack	0.0	0.1	0.1					
	Maximum flood	0.1	0.1	0.4					
	High slack	0.1	0.3	0.7					
	Maximum ebb	0.0	0.0	0.1					

* Gage out of water.
** ADACS failure.

Table 44

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for
a Monomorphic Deepwater Wave

Wave Direction, East; Wave Period, 8 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	*	6.8	4.6
	Maximum flood	6.3	7.4	6.7
	High slack	6.3	7.7	6.5
	Maximum ebb	6.1	6.3	3.5
2	Low slack	4.4	4.6	5.9
	Maximum flood	4.5	3.5	3.5
	High slack	4.4	4.6	5.2
	Maximum ebb	6.6	4.5	5.4
3	Low slack	1.5	1.0	1.0
	Maximum flood	3.4	1.9	1.5
	High slack	3.2	2.5	2.4
	Maximum ebb	1.7	1.7	0.5
4	Low slack	0.0	0.5	0.6
	Maximum flood	1.4	1.1	1.8
	High slack	1.6	1.4	2.1
	Maximum ebb	0.1	0.3	0.2
5	Low slack	3.9	3.2	6.1
	Maximum flood	5.9	4.2	5.9
	High slack	7.7	5.7	5.1
	Maximum ebb	4.3	4.8	5.4
6	Low slack	1.1	0.3	1.0
	Maximum flood	4.4	3.3	4.6
	High slack	3.1	4.0	4.9
	Maximum ebb	1.8	1.6	1.4
7	Low slack	0.0	0.1	0.2
	Maximum flood	0.1	0.2	0.8
	High slack	0.2	0.5	0.9
	Maximum ebb	0.0	0.0	0.2
8	Low slack	0.0	0.0	0.0
	Maximum flood	0.0	0.1	0.1
	High slack	0.1	0.2	0.3
	Maximum ebb	0.0	0.0	0.0
9	Low slack	0.0	0.3	0.3
	Maximum flood	0.4	0.2	0.4
	High slack	0.5	0.3	0.6
	Maximum ebb	0.1	0.1	0.1
10	Low slack	0.0	0.2	0.3
	Maximum flood	0.1	0.0	0.2
	High slack	0.2	0.1	0.2
	Maximum ebb	0.0	0.0	0.1
11	Low slack	0.0	0.0	0.0
	Maximum flood	0.0	0.0	0.0
	High slack	0.1	0.0	0.1
	Maximum ebb	0.0	0.1	0.0
12	Low slack	0.3	0.1	0.2
	Maximum flood	1.9	0.8	1.7
	High slack	1.5	1.4	1.6
	Maximum ebb	0.5	0.5	0.5
13	Low slack	0.6	0.3	0.3
	Maximum flood	1.6	1.4	1.7
	High slack	1.4	1.7	1.8
	Maximum ebb	0.6	0.7	0.5

* Gage out of water.

Table 45

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 5 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	1.7	2.8	2.0
	Maximum flood	2.1	2.3	2.6
	High slack	2.0	2.2	2.6
	Maximum ebb	2.0	3.0	2.0
2	Low slack	2.3	2.5	1.7
	Maximum flood	2.3	1.9	2.1
	High slack	2.3	2.1	2.4
	Maximum ebb	2.1	2.3	3.4
3	Low slack	0.7	0.8	0.4
	Maximum flood	2.4	0.5	0.5
	High slack	2.5	0.9	0.6
	Maximum ebb	1.5	1.1	0.3
4	Low slack	0.0	0.2	0.2
	Maximum flood	0.8	0.5	0.6
	High slack	1.0	0.7	0.5
	Maximum ebb	0.0	0.1	0.1
5	Low slack	0.5	1.3	1.3
	Maximum flood	0.4	0.5	1.3
	High slack	0.7	1.2	1.1
	Maximum ebb	0.6	1.0	1.4
6	Low slack	0.3	0.1	0.1
	Maximum flood	0.9	0.4	0.6
	High slack	1.1	1.1	0.8
	Maximum ebb	0.6	0.1	0.1
7	Low slack	0.0	0.0	0.0
	Maximum flood	0.0	0.0	0.2
	High slack	0.0	0.0	0.2
	Maximum ebb	0.0	0.0	0.0
8	Low slack	0.0	0.0	0.0
	Maximum flood	0.0	0.0	0.0
	High slack	0.0	0.0	0.0
	Maximum ebb	0.0	0.0	0.0
9	Low slack	0.0	0.1	0.1
	Maximum flood	0.2	0.1	0.1
	High slack	0.2	0.1	0.1
	Maximum ebb	0.1	0.1	0.0
10	Low slack	0.0	0.0	0.0
	Maximum flood	0.1	0.0	0.0
	High slack	0.1	0.0	0.0
	Maximum ebb	0.0	0.0	0.0
11	Low slack	0.0	0.0	0.0
	Maximum flood	0.0	0.0	0.0
	High slack	0.0	0.0	0.0
	Maximum ebb	0.0	0.0	0.0
12	Low slack	0.1	0.0	0.2
	Maximum flood	0.6	0.8	1.9
	High slack	0.6	0.7	1.4
	Maximum ebb	0.2	0.2	0.2
13	Low slack	0.2	0.1	0.1
	Maximum flood	1.7	1.3	1.2
	High slack	1.7	1.9	1.7
	Maximum ebb	0.5	0.4	0.3

Table 46

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 5 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D	Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	4.5	4.4	3.0	8	Low slack	0.0	0.0	0.0
	Maximum flood	4.8	4.0	4.1		Maximum flood	0.0	0.0	0.0
	High slack	5.1	5.3	4.2		High slack	0.0	0.0	0.0
	Maximum ebb	5.3	4.3	3.6		Maximum ebb	0.0	0.0	0.0
2	Low slack	5.2	4.5	3.4	9	Low slack	0.0	0.1	0.1
	Maximum flood	5.1	3.6	3.6		Maximum flood	0.3	0.1	0.1
	High slack	5.3	4.3	4.4		High slack	0.3	0.2	0.1
	Maximum ebb	5.5	6.7	4.9		Maximum ebb	0.1	0.1	0.0
3	Low slack	0.6	1.2	0.6	10	Low slack	0.0	0.0	0.0
	Maximum flood	3.3	2.0	0.9		Maximum flood	0.2	0.0	0.0
	High slack	3.1	1.4	1.4		High slack	0.1	0.0	0.0
	Maximum ebb	1.4	2.3	0.5		Maximum ebb	0.0	0.0	0.0
4	Low slack	0.0	0.3	0.3	11	Low slack	0.0	0.0	0.0
	Maximum flood	1.0	0.9	0.5		Maximum flood	0.0	0.0	0.0
	High slack	1.1	0.7	0.7		High slack	0.0	0.0	0.0
	Maximum ebb	0.1	0.3	0.1		Maximum ebb	0.0	0.0	0.0
5	Low slack	3.7	2.3	2.8	12	Low slack	0.1	0.0	0.1
	Maximum flood	2.3	3.0	2.0		Maximum flood	1.0	1.1	1.2
	High slack	4.9	4.5	2.1		High slack	1.7	2.1	1.3
	Maximum ebb	4.6	4.6	2.0		Maximum ebb	0.5	0.9	0.3
6	Low slack	0.5	0.1	0.2	13	Low slack	0.4	0.1	0.1
	Maximum flood	2.0	1.4	1.7		Maximum flood	2.1	1.4	1.4
	High slack	2.0	1.6	1.3		High slack	1.7	2.1	1.3
	Maximum ebb	1.1	0.8	0.4		Maximum ebb	0.5	0.9	0.3
7	Low slack	0.0	0.0	0.1					
	Maximum flood	0.1	0.1	0.2					
	High slack	0.1	0.1	0.4					
	Maximum ebb	0.0	0.0	0.0					

Table 47

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 8 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D	Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	5.0	5.4	6.3	8	Low slack	0.0	0.0	0.0
	Maximum flood	4.4	4.3	4.6		Maximum flood	0.1	0.1	0.0
	High slack	4.7	5.2	4.5		High slack	0.1	0.1	0.1
	Maximum ebb	4.9	6.1	7.6		Maximum ebb	0.0	0.0	0.0
2	Low slack	5.2	4.3	2.6	9	Low slack	0.0	0.2	0.1
	Maximum flood	5.1	4.1	5.5		Maximum flood	0.4	0.2	0.2
	High slack	5.5	4.2	5.7		High slack	0.4	0.3	0.2
	Maximum ebb	6.5	5.8	3.0		Maximum ebb	0.1	0.1	0.0
3	Low slack	0.9	0.8	0.8	10	Low slack	0.0	0.2	0.1
	Maximum flood	3.1	1.5	1.9		Maximum flood	0.4	0.2	0.2
	High slack	3.3	2.5	1.4		High slack	0.4	0.3	0.2
	Maximum ebb	1.6	1.9	0.5		Maximum ebb	0.1	0.1	0.0
4	Low slack	0.0	0.4	0.3	11	Low slack	0.0	0.2	0.1
	Maximum flood	1.3	0.7	1.2		Maximum flood	0.2	0.0	0.1
	High slack	1.6	1.1	1.2		High slack	0.2	0.1	0.1
	Maximum ebb	0.1	0.3	0.1		Maximum ebb	0.1	0.0	0.0
5	Low slack	3.6	2.5	2.7	12	Low slack	0.2	0.1	0.2
	Maximum flood	3.5	3.2	1.9		Maximum flood	1.7	0.9	1.7
	High slack	3.7	4.0	1.7		High slack	2.0	1.8	1.8
	Maximum ebb	3.3	3.3	5.0		Maximum ebb	0.5	0.6	0.6
6	Low slack	0.6	0.2	0.6	13	Low slack	0.4	0.2	0.1
	Maximum flood	3.1	2.5	2.4		Maximum flood	2.2	1.2	1.6
	High slack	3.4	2.4	2.5		High slack	1.8	1.7	1.8
	Maximum ebb	1.3	0.8	0.6		Maximum ebb	1.2	0.8	0.3
7	Low slack	0.0	0.0	0.1					
	Maximum flood	0.1	0.3	0.3					
	High slack	0.2	0.2	0.5					
	Maximum ebb	0.0	0.0	0.0					

Table 48

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for

a Monomorphic Deepwater Wave

Wave Direction, Southeast; Wave Period, 8 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D	Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	4.8	7.4	9.7	8	Low slack	0.0	0.0	0.0
	Maximum flood	4.5	5.9	6.6		Maximum flood	0.1	0.1	0.1
	High slack	3.9	4.5	5.9		High slack	0.1	0.2	0.1
	Maximum ebb	4.7	7.0	9.8		Maximum ebb	0.1	0.0	0.0
2	Low slack	6.2	5.1	3.5	9	Low slack	0.0	0.3	0.2
	Maximum flood	8.8	5.9	5.6		Maximum flood	0.5	0.4	0.3
	High slack	9.3	6.4	5.0		High slack	0.5	0.4	0.3
	Maximum ebb	8.0	9.4	4.2		Maximum ebb	0.1	0.1	0.0
3	Low slack	0.9	1.7	1.0	10	Low slack	0.0	0.3	0.1
	Maximum flood	3.3	4.0	1.4		Maximum flood	0.2	0.1	0.1
	High slack	3.7	5.0	2.0		High slack	0.2	0.1	0.1
	Maximum ebb	1.4	2.7	0.9		Maximum ebb	0.1	0.0	0.0
4	Low slack	0.0	0.6	0.3	11	Low slack	0.0	0.0	0.0
	Maximum flood	1.4	1.9	1.2		Maximum flood	0.1	0.0	0.0
	High slack	1.9	2.2	1.4		High slack	0.1	0.1	0.0
	Maximum ebb	0.2	0.6	0.3		Maximum ebb	0.1	0.1	0.0
5	Low slack	3.0	3.5	5.5	12	Low slack	0.2	0.1	0.3
	Maximum flood	6.5	5.8	4.8		Maximum flood	1.8	0.9	1.9
	High slack	7.1	8.7	5.5		High slack	1.6	1.4	1.8
	Maximum ebb	5.0	5.1	4.5		Maximum ebb	0.6	0.6	0.4
6	Low slack	1.2	0.8	1.0	13	Low slack	0.5	0.2	0.2
	Maximum flood	2.7	0.4	4.4		Maximum flood	2.3	1.6	1.7
	High slack	2.8	3.3	3.6		High slack	2.4	2.7	1.9
	Maximum ebb	1.8	2.0	1.5		Maximum ebb	1.5	1.3	0.4
7	Low slack	0.0	0.1	0.1					
	Maximum flood	0.2	0.2	0.6					
	High slack	0.2	0.4	0.4					
	Maximum ebb	0.1	0.1	0.1					

Table 49

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 5 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D	Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	1.8	2.1	1.3	8	Low slack	0.0	0.0	0.0
	Maximum flood	2.5	2.7	1.4		Maximum flood	0.0	0.0	0.0
	High slack	2.8	2.8	1.7		High slack	0.0	0.0	0.0
	Maximum ebb	2.3	2.9	1.8		Maximum ebb	0.0	0.0	0.0
2	Low slack	2.6	2.0	1.8	9	Low slack	0.0	0.1	0.0
	Maximum flood	2.6	2.4	1.8		Maximum flood	0.1	0.1	0.0
	High slack	2.9	3.1	2.2		High slack	0.2	0.2	0.1
	Maximum ebb	2.9	2.7	1.6		Maximum ebb	0.1	0.1	0.0
3	Low slack	0.4	0.5	0.2	10	Low slack	0.0	0.0	0.0
	Maximum flood	2.5	0.5	0.6		Maximum flood	0.2	0.2	0.0
	High slack	2.0	0.7	0.6		High slack	0.2	0.1	0.0
	Maximum ebb	1.0	0.4	0.2		Maximum ebb	0.0	0.0	0.0
4	Low slack	0.0	0.1	0.1	11	Low slack	0.0	0.0	0.0
	Maximum flood	1.2	0.4	0.3		Maximum flood	0.0	0.0	0.0
	High slack	0.9	0.6	0.4		High slack	0.0	0.0	0.0
	Maximum ebb	0.0	0.1	0.0		Maximum ebb	0.0	0.1	0.0
5	Low slack	0.9	1.6	0.5	12	Low slack	0.1	0.0	0.1
	Maximum flood	1.6	1.1	1.3		Maximum flood	0.6	0.8	0.5
	High slack	1.5	1.7	1.6		High slack	0.7	0.9	1.0
	Maximum ebb	1.4	1.0	0.9		Maximum ebb	0.2	0.1	0.1
6	Low slack	0.4	0.1	0.0	13	Low slack	0.1	0.1	0.1
	Maximum flood	2.6	1.0	0.3		Maximum flood	1.6	1.2	1.2
	High slack	2.6	1.4	0.6		High slack	2.6	2.3	1.3
	Maximum ebb	0.8	0.1	0.0		Maximum ebb	0.2	0.4	0.2
7	Low slack	0.0	0.0	0.0					
	Maximum flood	0.1	0.1	0.1					
	High slack	0.1	0.1	0.1					
	Maximum ebb	0.0	0.0	0.0					

Table 50

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for
a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 5 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D	Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	2.6	1.9	2.8	8	Low slack	0.0	0.0	0.0
	Maximum flood	3.9	3.3	3.2		Maximum flood	0.0	0.0	0.0
	High slack	4.0	4.3	3.1		High slack	0.1	0.0	0.1
	Maximum ebb	3.9	2.8	4.0		Maximum ebb	0.0	0.0	0.0
2	Low slack	3.2	2.6	2.4	9	Low slack	0.0	0.1	0.1
	Maximum flood	4.6	4.0	3.6		Maximum flood	0.2	0.1	0.1
	High slack	4.6	4.7	4.2		High slack	0.2	0.2	0.2
	Maximum ebb	4.2	3.9	1.8		Maximum ebb	0.1	0.1	0.0
3	Low slack	4.9	0.7	0.3	10	Low slack	0.0	0.0	0.0
	Maximum flood	2.7	1.0	1.2		Maximum flood	0.2	0.0	0.0
	High slack	2.6	1.1	1.1		High slack	0.2	0.1	0.1
	Maximum ebb	1.0	0.4	0.3		Maximum ebb	0.0	0.0	0.0
4	Low slack	0.0	0.2	0.2	11	Low slack	0.0	0.0	0.0
	Maximum flood	1.0	0.9	0.7		Maximum flood	0.0	0.0	0.0
	High slack	0.8	0.8	0.5		High slack	0.2	0.1	0.1
	Maximum ebb	0.0	0.2	0.0		Maximum ebb	0.0	0.0	0.0
5	Low slack	2.1	1.6	1.3	12	Low slack	0.1	0.1	0.1
	Maximum flood	4.1	1.2	3.5		Maximum flood	0.8	1.3	0.9
	High slack	4.3	2.7	3.0		High slack	0.8	1.1	1.3
	Maximum ebb	2.6	1.7	1.9		Maximum ebb	0.2	0.1	0.3
6	Low slack	0.5	0.1	0.1	13	Low slack	0.2	0.0	0.1
	Maximum flood	1.8	1.7	1.8		Maximum flood	1.0	0.7	0.8
	High slack	1.8	2.0	1.3		High slack	1.3	1.2	1.1
	Maximum ebb	0.6	0.6	0.3		Maximum ebb	0.2	0.4	0.2
7	Low slack	0.0	0.1	0.0					
	Maximum flood	0.1	0.1	0.2					
	High slack	0.1	0.2	0.2					
	Maximum ebb	0.0	0.1	0.0					

Table 51

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 8 sec; Wave Height, 3 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D	Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	2.6	2.9	1.8	8	Low slack	0.0	0.0	0.0
	Maximum flood	2.5	2.5	2.3		Maximum flood	0.0	0.0	0.0
	High slack	2.8	2.6	2.3		High slack	0.0	0.1	0.1
	Maximum ebb	2.8	2.6	2.0		Maximum ebb	0.0	0.0	0.0
2	Low slack	2.7	1.7	1.6	9	Low slack	0.0	0.2	0.1
	Maximum flood	3.0	2.3	1.8		Maximum flood	0.2	0.1	0.1
	High slack	3.2	2.8	2.4		High slack	0.3	0.2	0.1
	Maximum ebb	2.4	1.0	2.6		Maximum ebb	0.1	0.1	0.0
3	Low slack	0.7	0.8	0.5	10	Low slack	0.0	0.1	0.1
	Maximum flood	4.2	0.6	0.6		Maximum flood	0.1	0.0	0.1
	High slack	4.7	1.3	0.5		High slack	0.1	0.1	0.1
	Maximum ebb	1.2	1.2	0.2		Maximum ebb	0.0	0.0	0.0
4	Low slack	0.0	0.3	0.2	11	Low slack	0.0	0.0	0.0
	Maximum flood	0.9	0.9	0.6		Maximum flood	0.1	0.0	0.0
	High slack	0.8	0.9	0.5		High slack	0.1	0.0	0.0
	Maximum ebb	0.0	0.2	0.0		Maximum ebb	0.0	0.1	0.0
5	Low slack	2.1	2.2	2.8	12	Low slack	0.1	0.1	0.1
	Maximum flood	1.6	1.8	1.8		Maximum flood	0.8	1.0	1.4
	High slack	1.9	1.6	1.8		High slack	0.7	1.3	1.1
	Maximum ebb	1.6	2.6	1.7		Maximum ebb	0.3	0.2	0.3
6	Low slack	0.7	0.3	0.2	13	Low slack	0.2	0.1	0.1
	Maximum flood	2.1	1.9	1.4		Maximum flood	2.6	1.6	1.5
	High slack	1.9	1.5	0.9		High slack	2.5	2.1	1.7
	Maximum ebb	0.9	0.9	0.1		Maximum ebb	0.4	0.8	0.3
7	Low slack	0.0	0.1	0.1					
	Maximum flood	0.1	0.2	0.2					
	High slack	0.1	0.3	0.4					
	Maximum ebb	0.0	0.0	0.0					

Table 52

Plan 1D Wave Tests

Comparison of Significant Wave Heights (ft) for a Monomorphic Deepwater Wave

Wave Direction, South; Wave Period, 8 sec; Wave Height, 5 ft

Gage No.	Flow Condition	Base	Plan 1B	Plan 1D	Gage No.	Flow Condition	Base	Plan 1B	Plan 1D
1	Low slack	4.8	4.0	4.2	8	Low slack	0.0	0.0	0.0
	Maximum flood	4.6	4.5	3.4		Maximum flood	0.0	0.1	0.1
	High slack	4.4	4.3	3.8		High slack	0.0	0.2	0.1
	Maximum ebb	4.3	3.8	3.7		Maximum ebb	0.0	0.0	0.0
2	Low slack	3.8	4.1	2.6	9	Low slack	0.0	0.2	0.2
	Maximum flood	6.2	5.5	4.2		Maximum flood	0.3	0.1	0.2
	High slack	5.9	6.2	5.3		High slack	0.3	0.4	0.3
	Maximum ebb	5.5	3.1	5.3		Maximum ebb	0.1	0.1	0.0
3	Low slack	1.0	1.0	0.6	10	Low slack	0.0	0.1	0.1
	Maximum flood	3.6	2.1	1.4		Maximum flood	0.2	0.0	0.1
	High slack	3.6	2.8	1.8		High slack	0.2	0.1	0.1
	Maximum ebb	1.2	2.1	0.4		Maximum ebb	0.0	0.0	0.0
4	Low slack	0.0	0.4	0.3	11	Low slack	0.0	0.0	0.0
	Maximum flood	1.0	1.5	1.1		Maximum flood	0.1	0.0	0.0
	High slack	1.1	1.9	0.8		High slack	0.1	0.0	0.0
	Maximum ebb	0.0	0.4	0.1		Maximum ebb	0.0	0.1	0.0
5	Low slack	3.1	3.1	4.3	12	Low slack	0.1	0.1	0.2
	Maximum flood	3.7	2.5	3.6		Maximum flood	0.9	1.5	1.5
	High slack	4.2	3.0	3.3		High slack	0.8	1.7	1.4
	Maximum ebb	3.9	4.1	3.8		Maximum ebb	0.3	0.4	0.4
6	Low slack	0.8	0.3	0.4	13	Low slack	0.3	0.3	0.1
	Maximum flood	1.8	1.7	3.1		Maximum flood	1.9	1.9	2.0
	High slack	2.2	2.8	2.3		High slack	2.5	2.1	2.3
	Maximum ebb	1.1	1.1	0.5		Maximum ebb	0.6	0.7	0.3
7	Low slack	0.0	0.1	0.1					
	Maximum flood	0.1	0.3	0.4					
	High slack	0.1	0.4	0.4					
	Maximum ebb	0.0	0.0	0.0					

Table 53

Final Plan Tide Tests

Comparison of Tidal Amplitudes of the Principal Lunar Constituent (ft)

Station	Base II	Plan 1D	Difference from Base	Plan 1E	Difference from Base	Plan 1F	Difference from Base	Plan 1G	Difference from Base	Plan 1H	Difference from Base
1	1.72	1.77	+0.05	1.72	0.00	1.72	0.00	1.71	-0.01	1.70	-0.02
2	1.79	1.91	+0.12	1.82	+0.03	1.82	+0.03	1.81	+0.02	1.81	+0.02
3	1.80	1.95	+0.15	1.82	+0.02	1.82	+0.02	1.81	+0.01	1.81	+0.01
4	1.88	2.25	+0.37	2.22	+0.34	2.23	+0.35	2.21	+0.33	2.23	+0.35
5	1.84	2.01	+0.17	1.92	+0.08	1.92	+0.08	1.91	+0.07	1.92	+0.08
6	1.87	2.19	+0.32	2.17	+0.30	2.18	+0.31	2.16	+0.29	2.18	+0.31
7	1.82	1.87	+0.05	1.88	+0.06	1.88	+0.06	1.88	+0.06	1.88	+0.06
8	2.40	2.41	+0.01	2.41	+0.01	2.41	+0.01	2.41	+0.01	2.43	+0.03

Table 54

Final Plan Tide Tests

Comparison of Mean Tide Levels of the Principal Lunar Constituent (ft mlw)

Station	Base II	Plan 1D	Difference from Base	Plan 1E	Difference from Base	Plan 1F	Difference from Base	Plan 1G	Difference from Base	Plan 1H	Difference from Base
1	2.73	2.77	+0.04	2.80	+0.07	2.78	+0.05	2.78	+0.05	2.80	+0.07
2	2.70	2.67	-0.03	2.75	+0.05	2.74	+0.04	2.72	+0.02	2.75	+0.05
3	2.55	2.61	+0.06	2.67	+0.12	2.66	+0.11	2.65	+0.10	2.69	+0.14
4	2.66	2.48	-0.18	2.47	-0.19	2.45	-0.21	2.45	-0.21	2.47	-0.19
5	2.68	2.65	-0.03	2.71	+0.03	2.69	+0.01	2.67	-0.01	2.68	0.00
6	2.66	2.52	-0.14	2.54	-0.12	2.52	-0.14	2.51	-0.15	2.53	-0.13
7	2.76	2.79	+0.03	2.78	+0.02	2.76	0.00	2.76	0.00	2.77	+0.01
8	2.37	2.38	+0.01	2.36	-0.01	2.35	-0.02	2.35	-0.02	2.38	+0.01

Table 55

Final Plan Tide Tests

Comparison of Phase Differences of the Principal Lunar Constituent (deg*)

Station to Station	Base II	Plan 1D	Difference from Base	Plan 1E	Difference from Base	Plan 1F	Difference from Base	Plan 1G	Difference from Base	Plan 1H	Difference from Base
8-1	49.2	48.7	-0.5	50.5	+1.3	50.0	+0.8	50.5	+1.3	51.1	+1.9
8-2	34.2	31.8	-2.4	34.1	-0.1	33.5	-0.7	34.4	+0.2	34.7	+0.5
8-3	20.2	19.5	-0.7	22.8	+2.6	22.0	+1.8	23.2	+3.0	23.0	+2.8
8-4	20.3	14.0	-6.3	15.6	-4.7	14.7	-5.6	15.9	-4.4	16.0	-4.3
8-5	33.1	28.4	-4.7	30.3	-2.8	29.6	-3.5	30.6	-2.5	30.7	-2.4
8-6	32.5	25.4	-7.1	26.8	-5.7	25.9	-6.6	27.0	-5.5	27.0	-5.5
8-7	46.8	44.7	-2.1	44.8	-2.0	44.3	-2.5	44.7	-2.1	45.0	-1.8

* 1 degree of phase lag equals 2.07 minutes of prototype time.

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS
BASE TEST
HOUR 0

PHOTO 1

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS
BASE TEST
HOUR 1

PHOTO 2

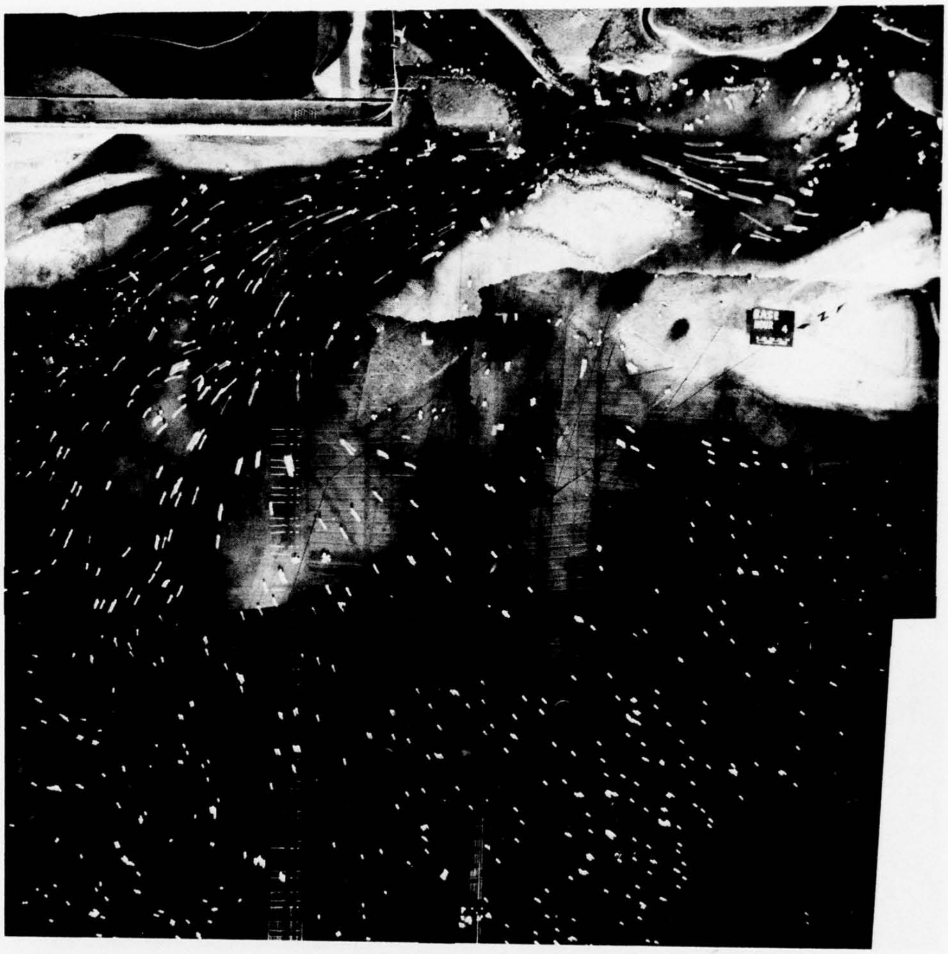
VELOCITY SCALE
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS
BASE TEST
HOUR 2

PHOTO 3

SURFACE CURRENT
PATTERNS
BASE TEST
HOUR 3

PHOTO 4



VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS
BASE TEST
HOUR 4

PHOTO 5

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS

BASE TEST

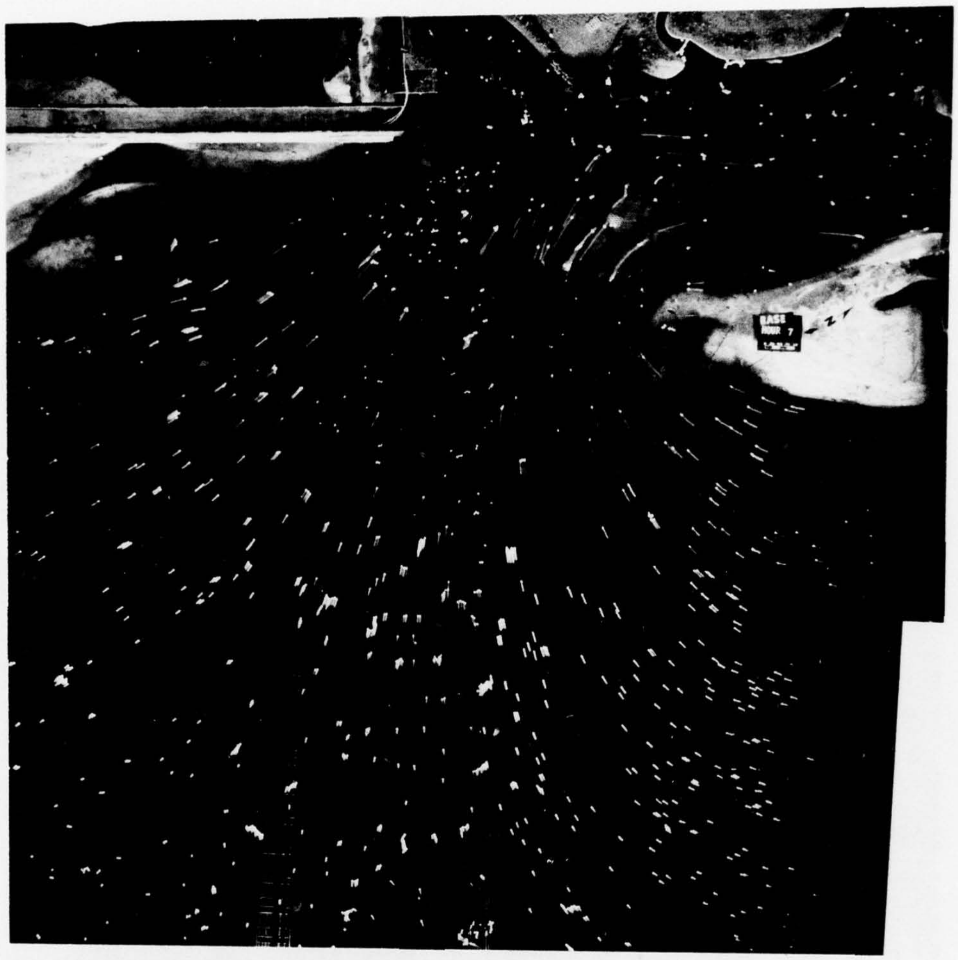
HOUR 5

PHOTO 6

VELOCITY SCALE
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS
BASE TEST
HOUR 6

PHOTO 7



VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS
BASE TEST
HOUR 7

PHOTO 8

VELOCITY SCALE

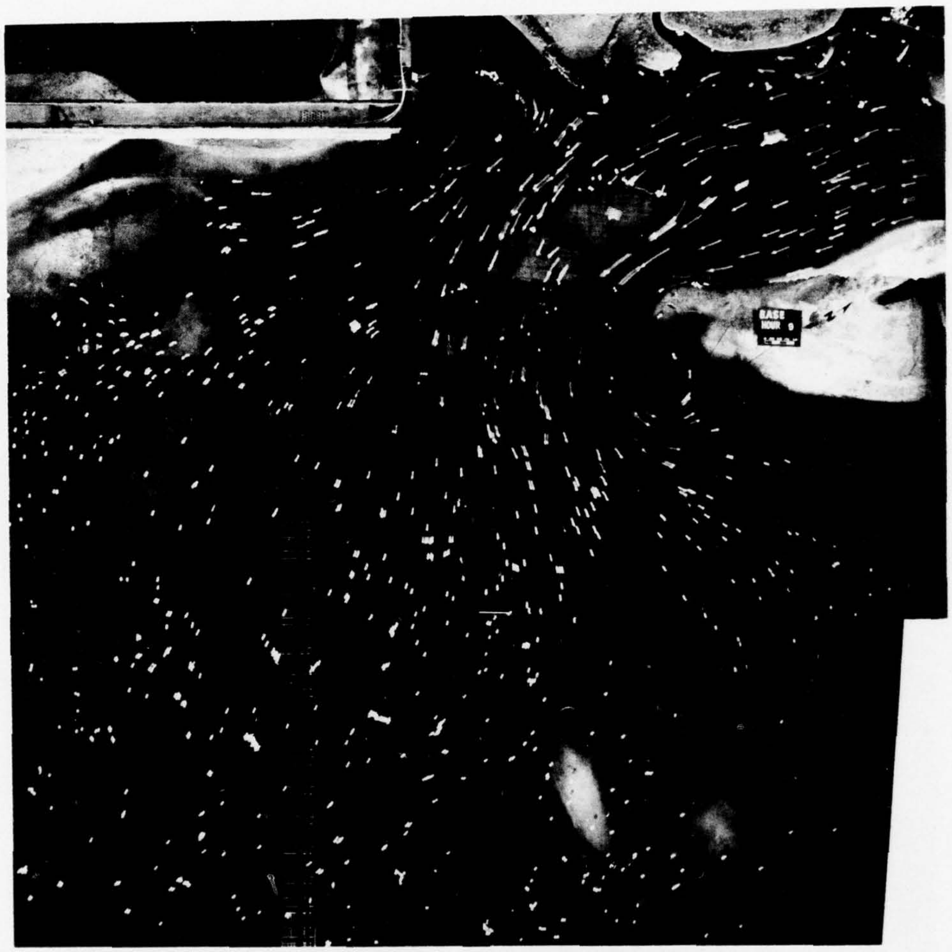
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

BASE TEST

HOUR 8

PHOTO 9



VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS
BASE TEST
HOUR 9

PHOTO 10

VELOCITY SCALE
2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS
BASE TEST
HOUR 10

PHOTO 11

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS

BASE TEST

HOUR 11

PHOTO 12

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

BASE TEST

HOUR 12

PHOTO 13

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 1

HOUR 4

PHOTO 14

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 1

HOUR 7

PHOTO 15

VELOCITY SCALE
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS
PLAN 1
HOUR 9

PHOTO 16

VELOCITY SCALE

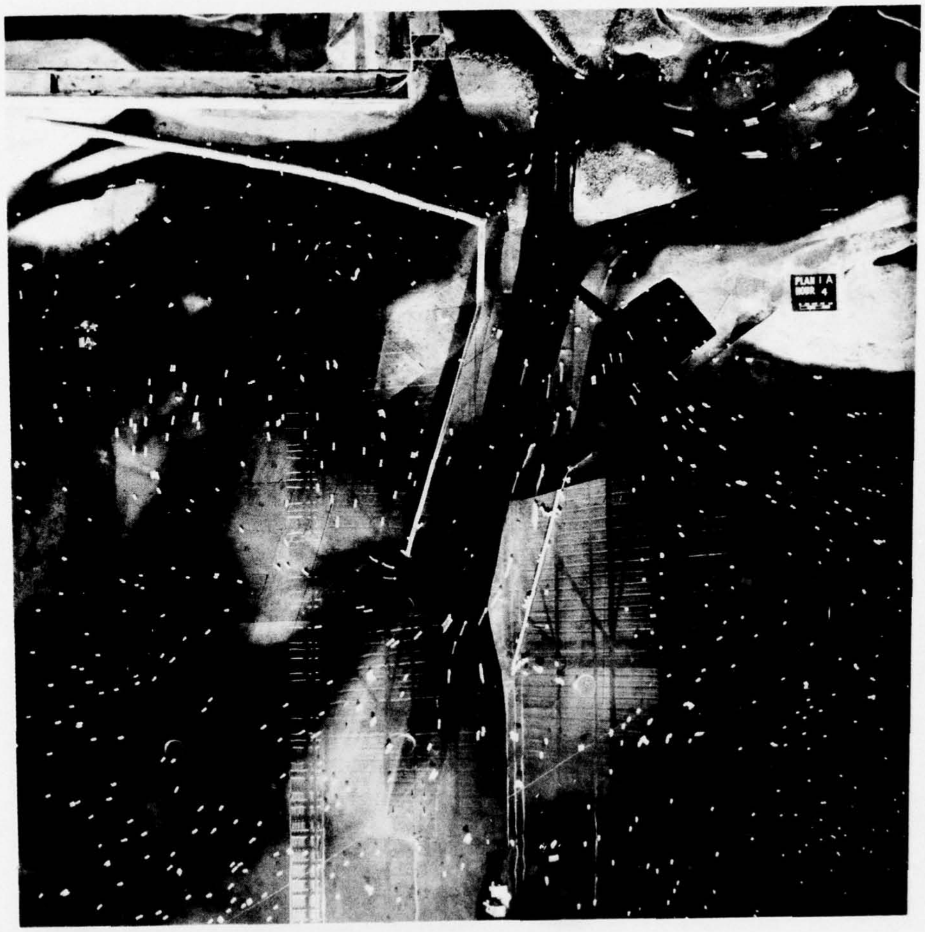
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 1

HOUR 12

PHOTO 17



VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS

PLAN 1A

HOUR 4

PHOTO 18

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 1A

HOUR 7

PHOTO 19

VELOCITY SCALE

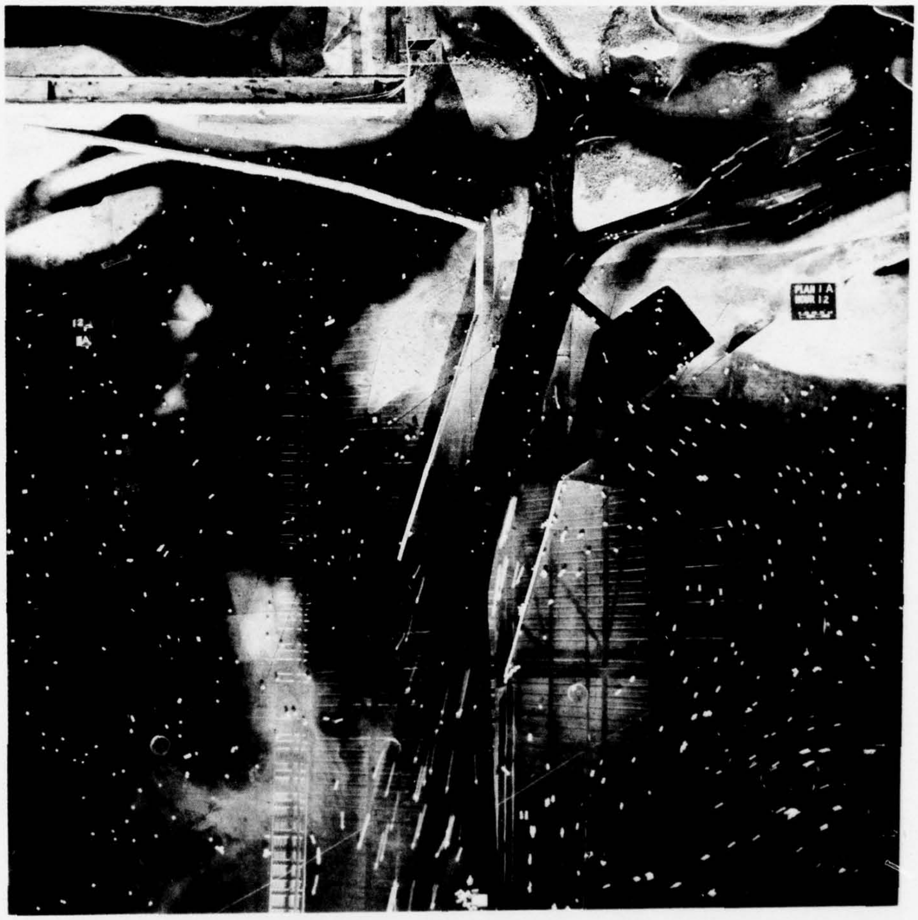
2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS

PLAN 1A

HOUR 9

PHOTO 20



VELOCITY SCALE

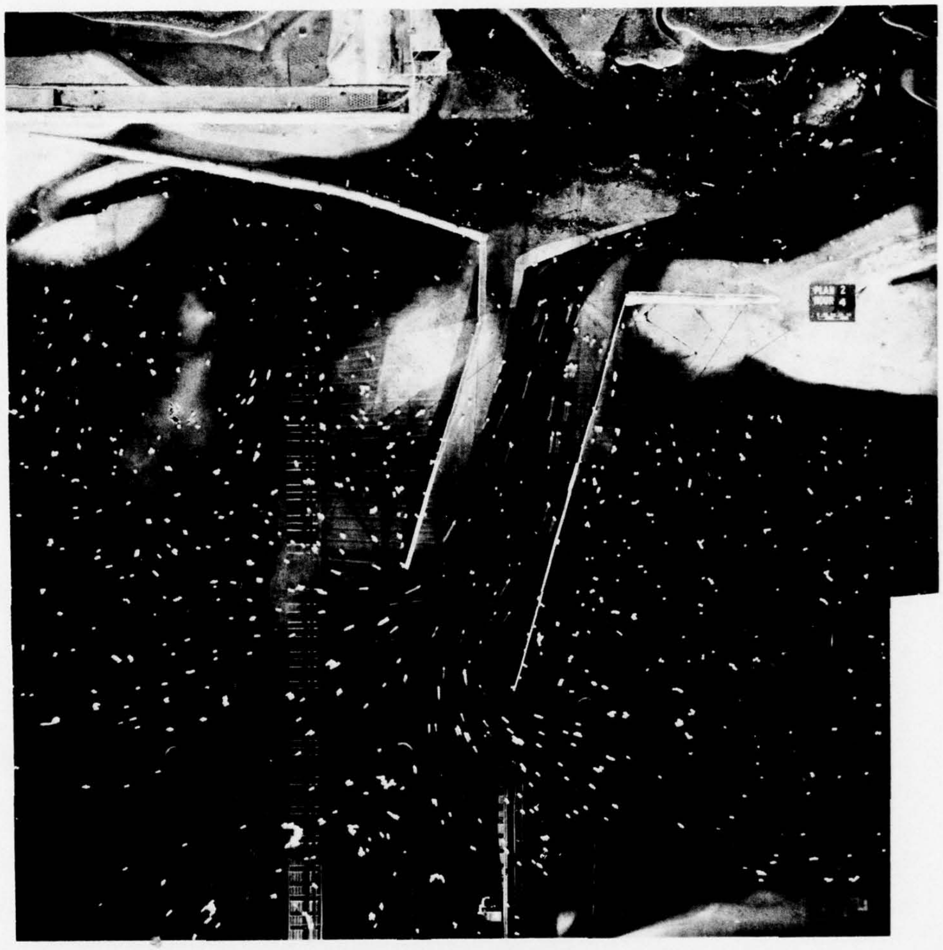
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 1A

HOUR 12

PHOTO 21

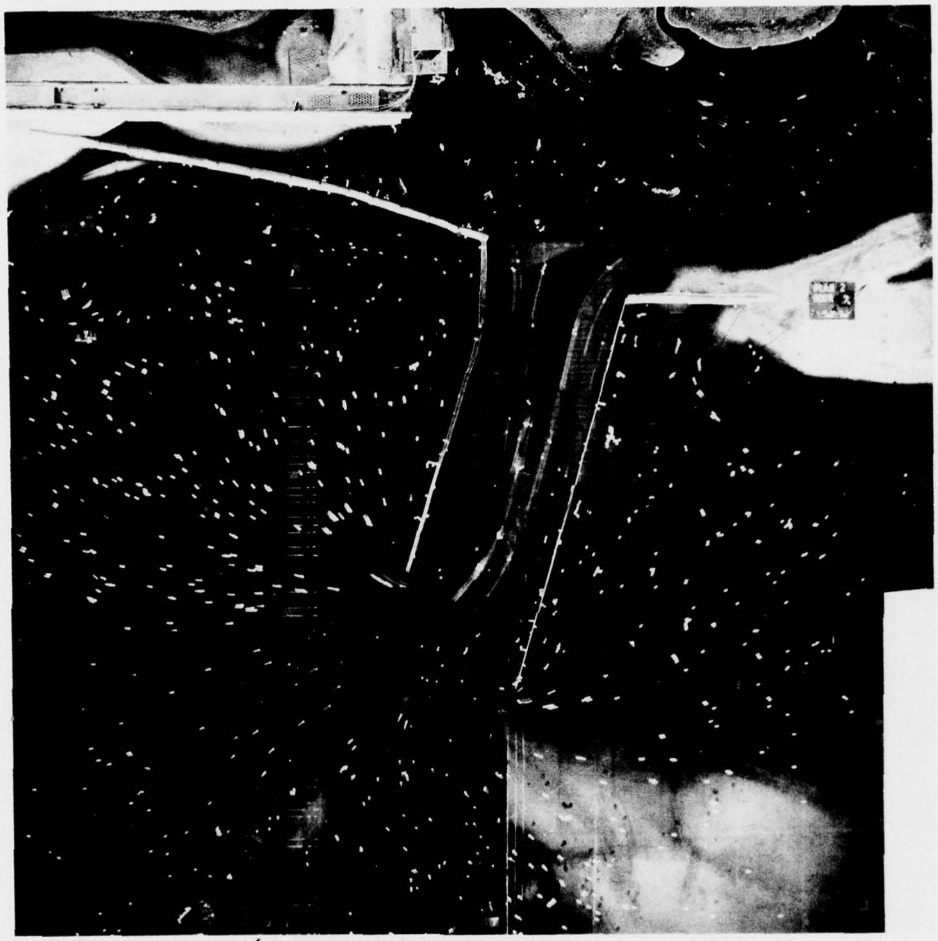


VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS
PLAN 2
HOUR 4

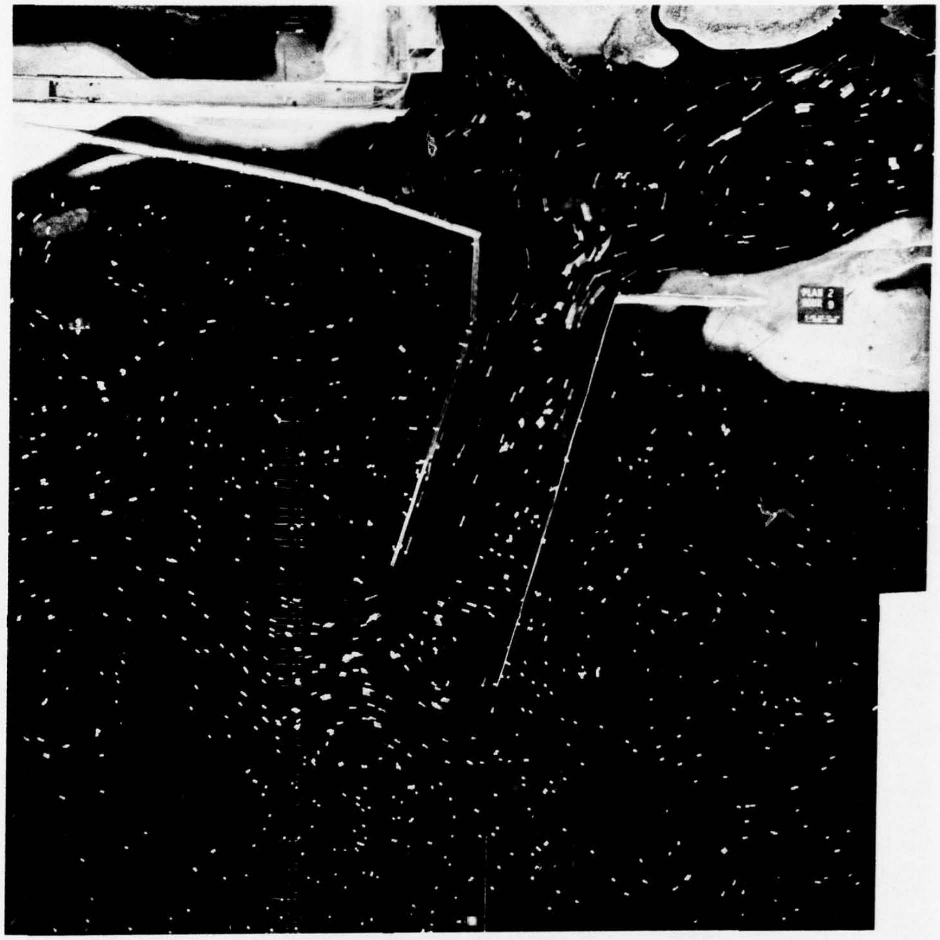
PHOTO 22



VELOCITY SCALE
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS
PLAN 2
HOUR 7

PHOTO 23



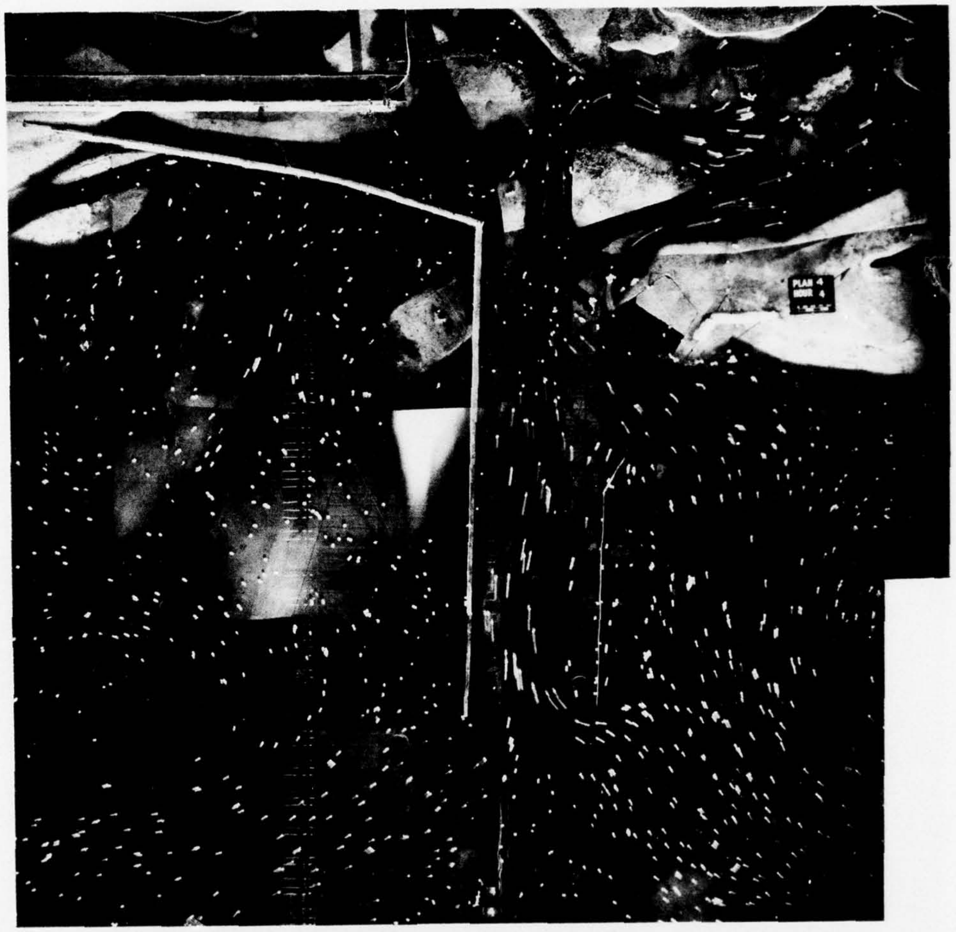
SURFACE CURRENT
PATTERNS
PLAN 2
HOUR 9

PHOTO 24

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS
PLAN 2
HOUR 12



VELOCITY SCALE

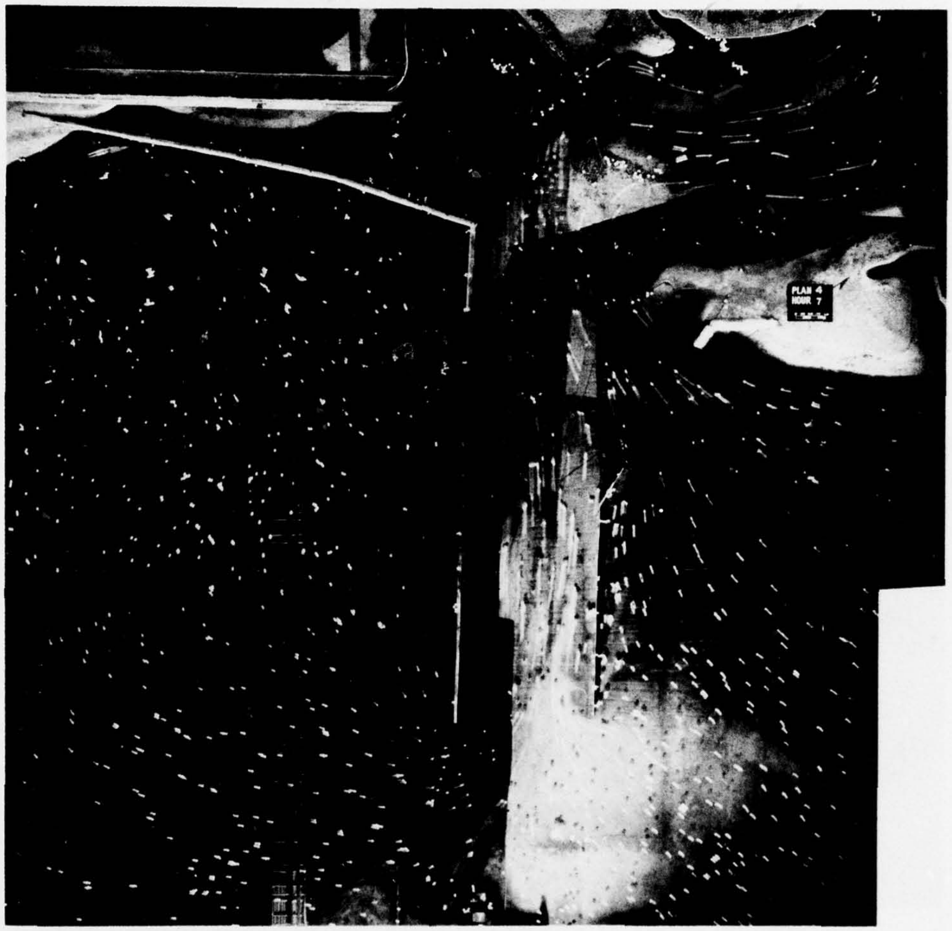
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 4

HOUR 4

PHOTO 26



VELOCITY SCALE

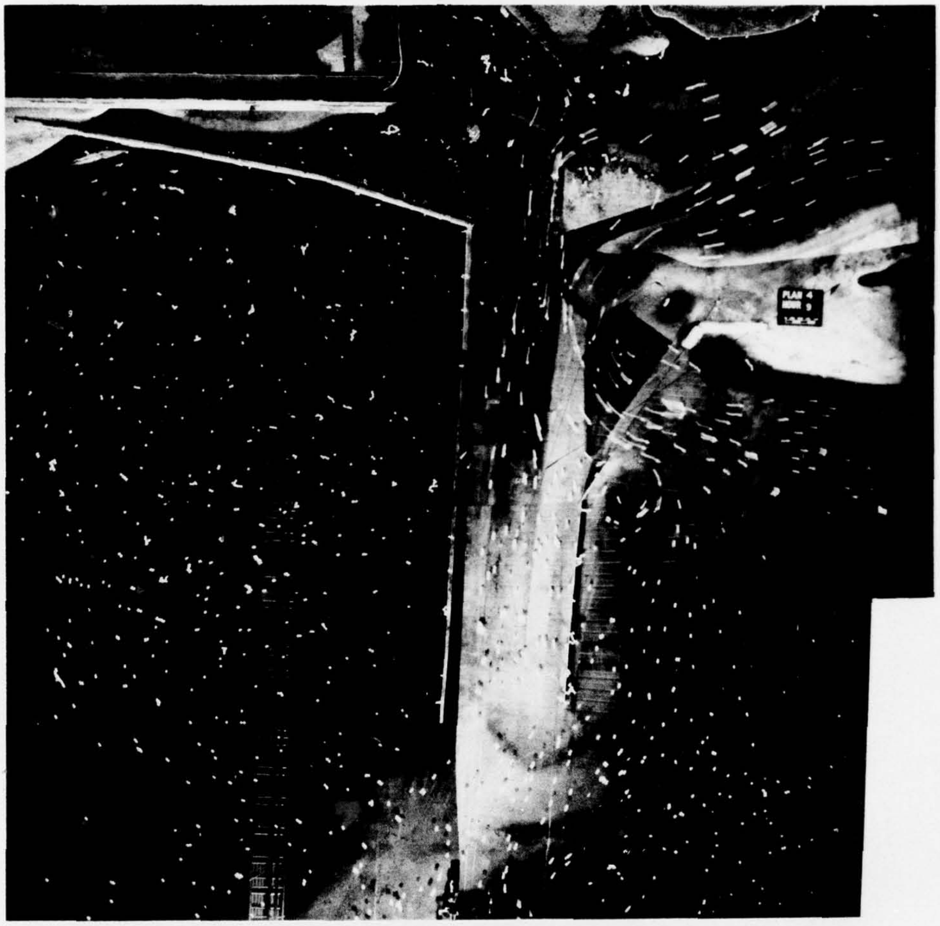
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 4

HOUR 7

PHOTO 27



VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 4

HOUR 9

PHOTO 28

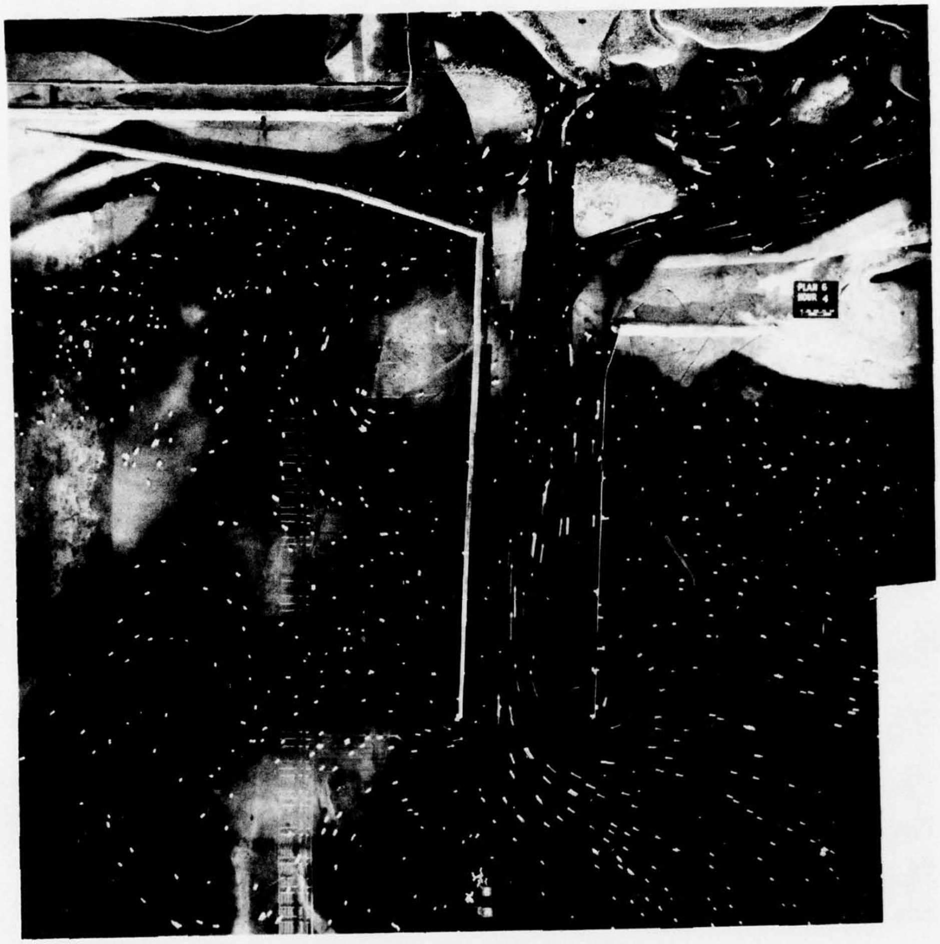
VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 4

HOUR 12



VELOCITY SCALE

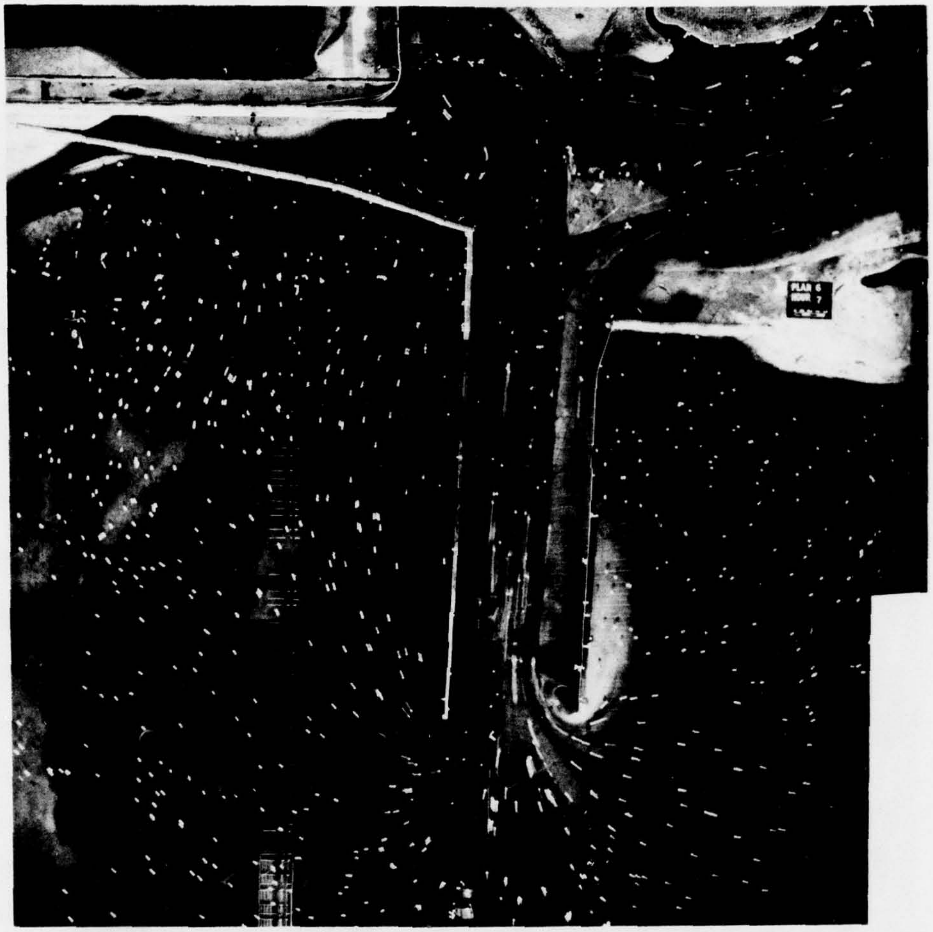
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 6

HOUR 4

PHOTO 30



VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 6

HOUR 7

PHOTO 31

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 6

HOUR 9

PHOTO 32

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 6

HOUR 12

PHOTO 33

VELOCITY SCALE

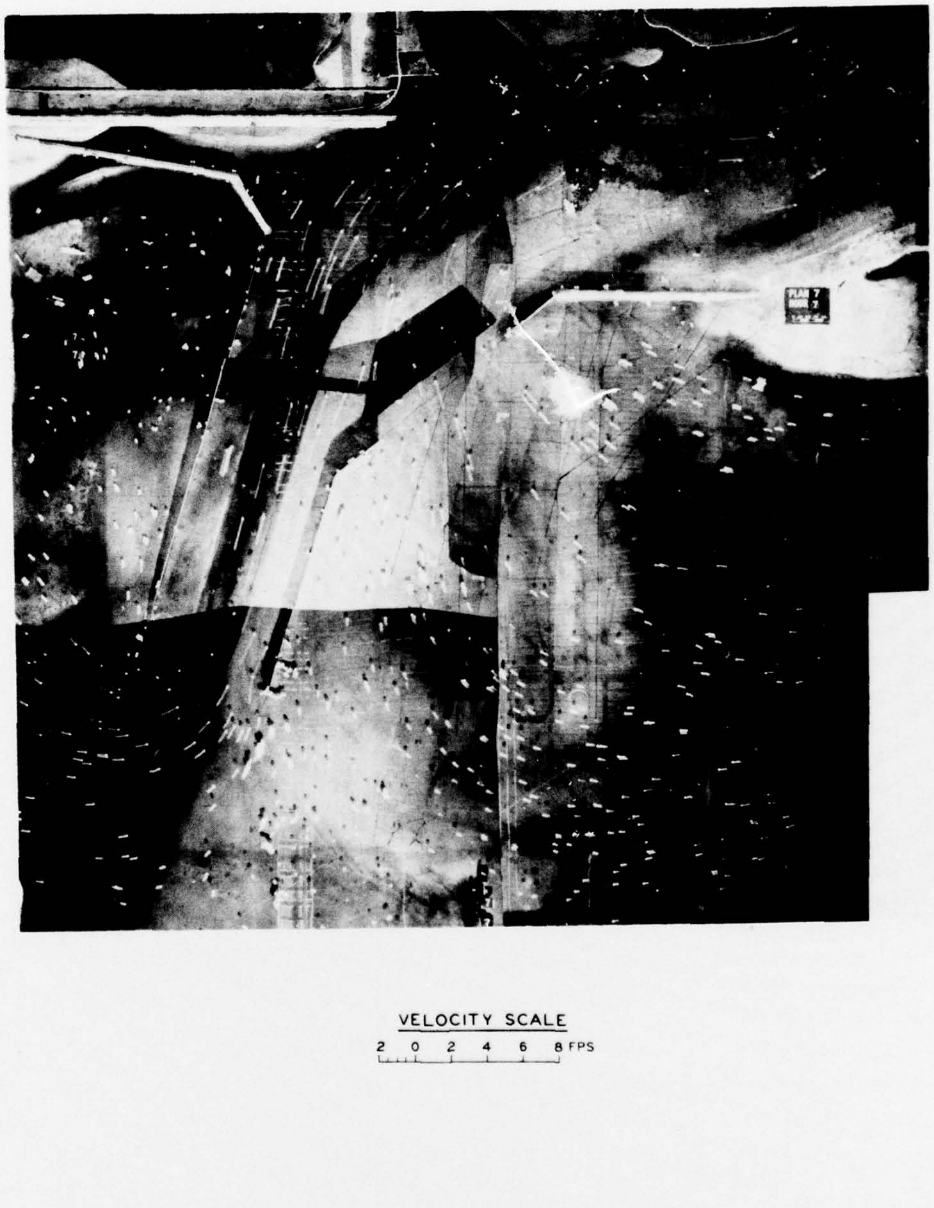
2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 7

HOUR 4

PHOTO 34



VELOCITY SCALE
2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS
PLAN 7
HOUR 7

PHOTO 35

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT PATTERNS

PLAN 7

HOUR 9

PHOTO 36

VELOCITY SCALE

2 0 2 4 6 8 FPS

SURFACE CURRENT
PATTERNS
PLAN 7
HOUR 12

PHOTO 37

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1B HOUR 4

PHOTO 38

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

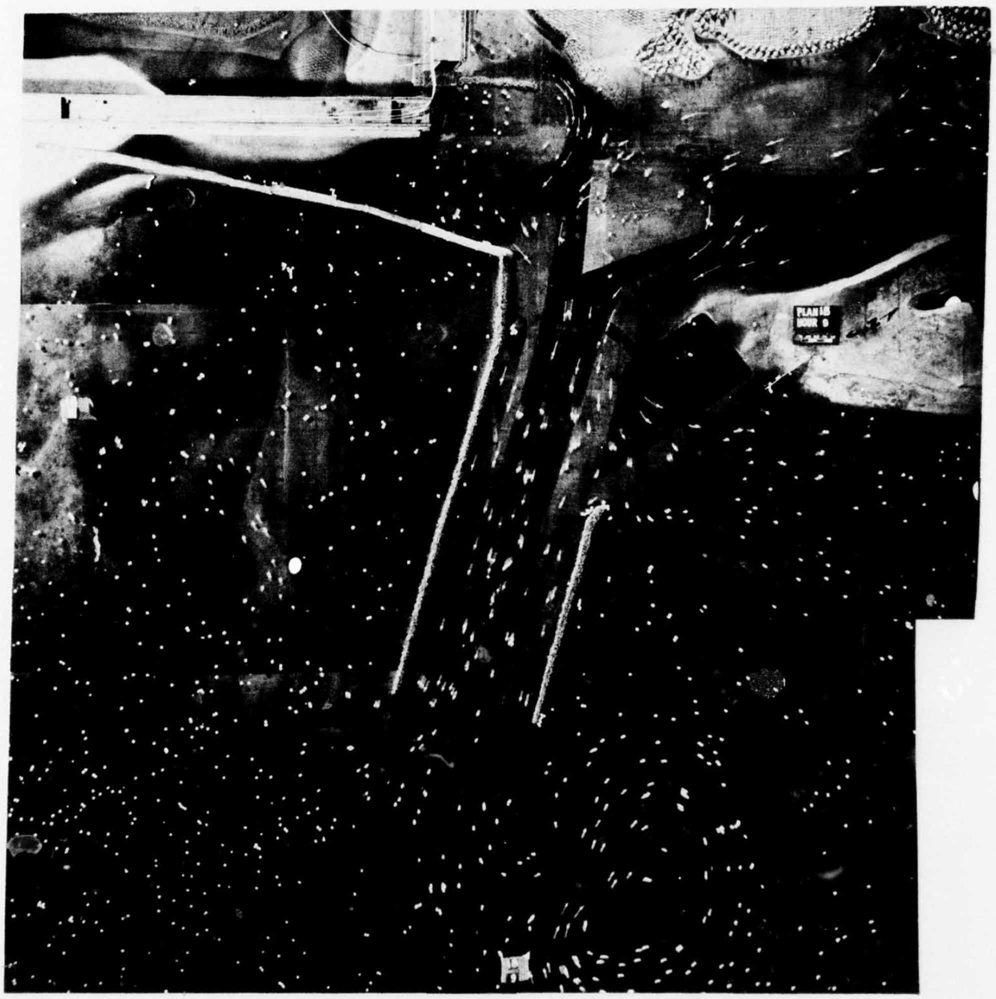
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1B HOUR 7

PHOTO 39



VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT
PATTERNS

PLAN 1B HOUR 9

PHOTO 40

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

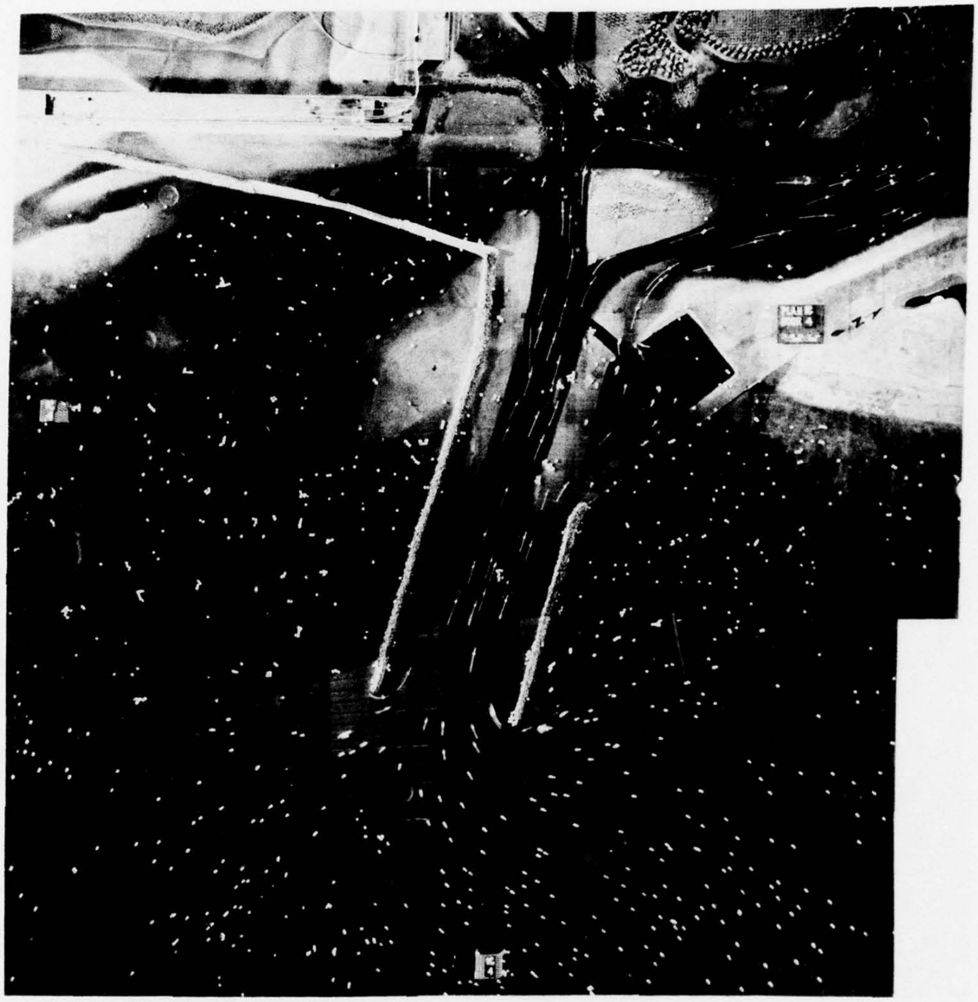
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1B HOUR 12

PHOTO 41



VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1C HOUR 4

PHOTO 42

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1C HOUR 7

PHOTO 43

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT
PATTERNS

PLAN 1C HOUR 9

PHOTO 44

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

MURRELLS INLET, SOUTH CAROLINA
HYDRAULIC MODEL STUDY

SURFACE CURRENT PATTERNS

PLAN 1C HOUR 12

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4 8 FEET

SURFACE CURRENT PATTERNS

PLAN 7A HOUR 4

PHOTO 46

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 7A HOUR 7

PHOTO 47

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 7A HOUR 9

PHOTO 48

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 7A HOUR 12

PHOTO 49

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 7B HOUR 4

PHOTO 50

VELOCITY SCALE

2 0 2 4 6 8 FPS

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 7B HOUR 7

PHOTO 51

VELOCITY SCALE

2 0 2 4 6 8 FPS

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 7B HOUR 9

PHOTO 52

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT
PATTERNS

PLAN 7B HOUR 12

PHOTO 53

VELOCITY SCALE

2 0 2 4 6 8 FPS

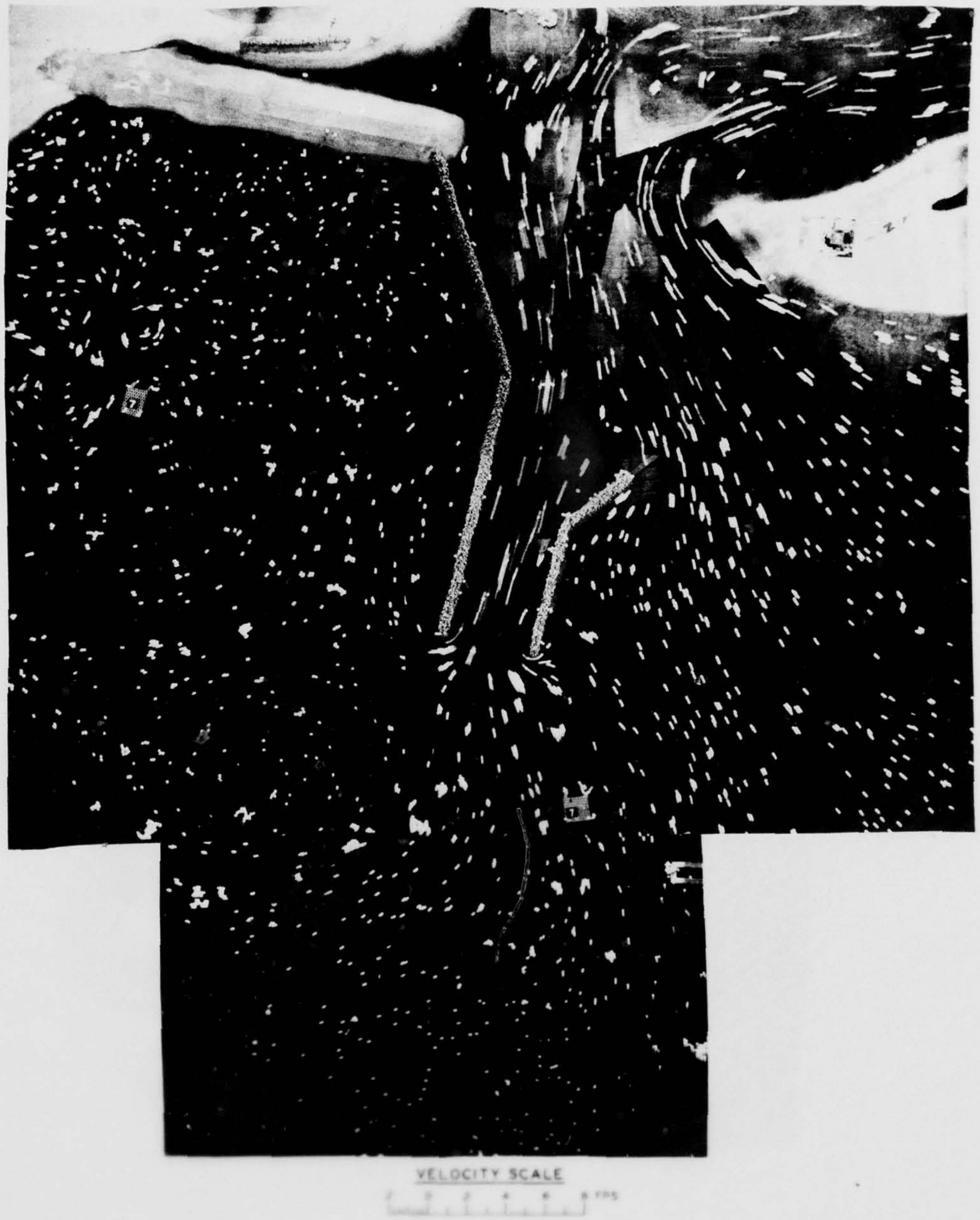
TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT
PATTERNS

PLAN 1D HOUR 4

PHOTO 54



TEST CONDITIONS

SURFACE CURRENT
PATTERNS

VELOCITY SCALE

2 0 2 4 6 8 FPS

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 10 HOUR 9

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1D HOUR 12

PHOTO 87

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1E HOUR 4

PHOTO [illegible]

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1E HOUR 7

PHOTO 59

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT
PATTERNS

PLAN 1E HOUR 9

PHOTO 60

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

MURRELLS INLET, SOUTH CAROLINA

HYDRAULIC MODEL STUDY

SURFACE CURRENT PATTERNS

PLAN 1E HOUR 12

PHOTO 61

VELOCITY SCALE
2 0 2 4 6 8

TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS
PLAN 1F HOUR 4

PHOTO 62

VELOCITY SCALE
2 0 2 4 6 8

TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS
PLAN 1F HOUR 7

PHOTO 63

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1F HOUR 9

PHOTO 64

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT
PATTERNS

PLAN 1F HOUR 12

PHOTO 65

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1G HOUR 4

PHOTO 66

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE ≈ 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1G HOUR 7

PHOTO 67

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT
PATTERNS

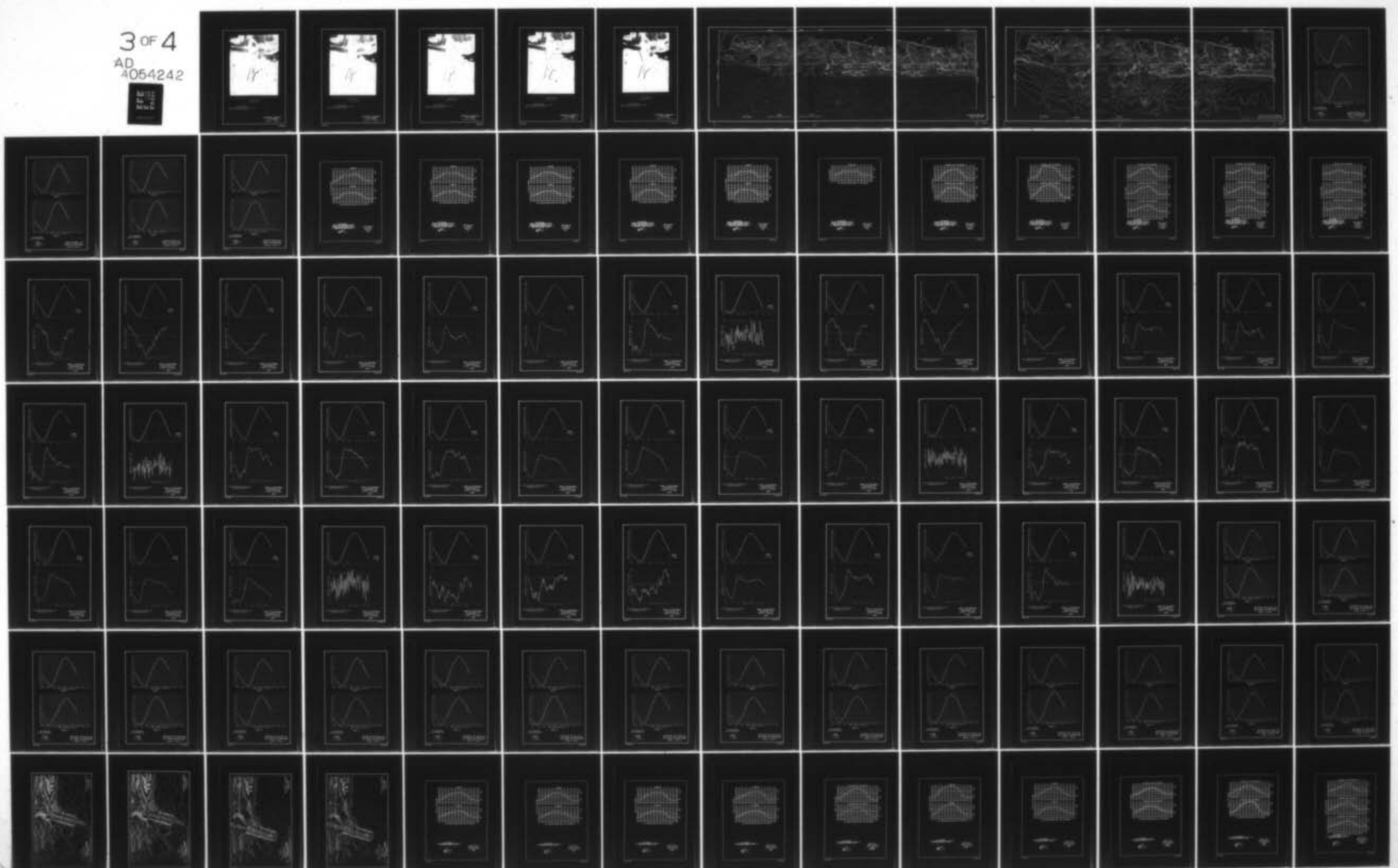
PLAN 1G HOUR 9

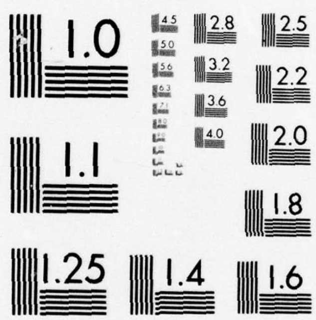
PHOTO 68

AD-A054 242 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 8/3
IMPROVEMENTS FOR MURRELLS INLET, SOUTH CAROLINA. HYDRAULIC MODE--ETC(U)
APR 78 F C PERRY, W C SEABERGH, E F LANE

UNCLASSIFIED WES-TR-H-78-4 NL

3 OF 4
AD
A054242





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1G HOUR 12

PHOTO 69

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1H HOUR 4

PHOTO 70

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT PATTERNS

PLAN 1H HOUR 7

PHOTO 71

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT
PATTERNS

PLAN 1H HOUR 9

PHOTO 72

VELOCITY SCALE

2 0 2 4 6 8

TEST CONDITIONS

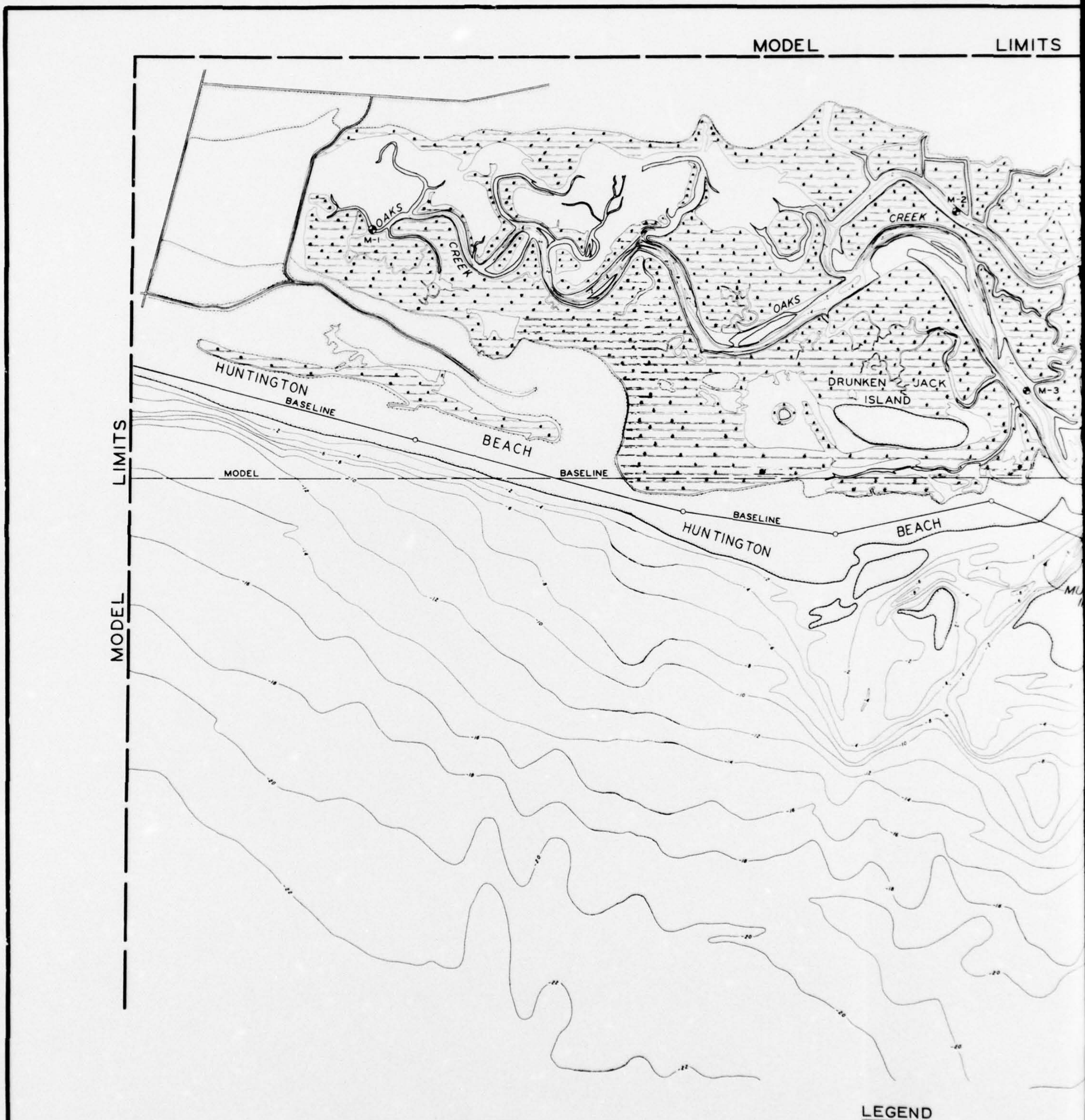
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE

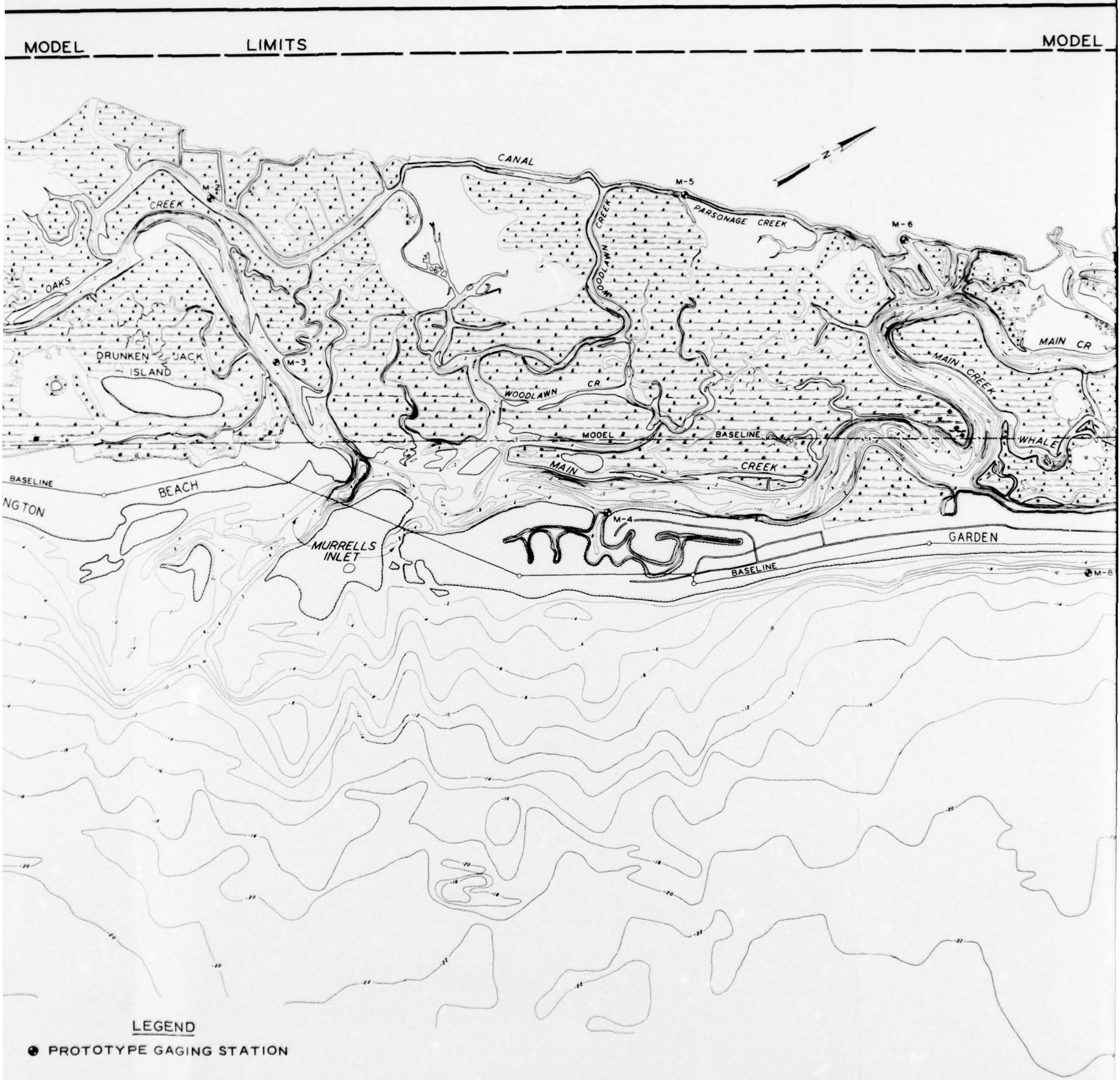
MODEL OCEAN TIDE RANGE = 4.8 FEET

SURFACE CURRENT
PATTERNS

PLAN 1H HOUR 12

PHOTO 73


MODEL LIMITS
MODEL LIMITS
OAKS
M-1
CREEK
OAKS
CREEK
M-2
M-3
DRUNKEN JACK
ISLAND
HUNTINGTON
BASELINE
BEACH
MODEL
BASELINE
BASELINE
HUNTINGTON
BEACH
SCALE IN FEET
500 0 500 1000
LEGEND
PROTOTYPE GAGING STATION

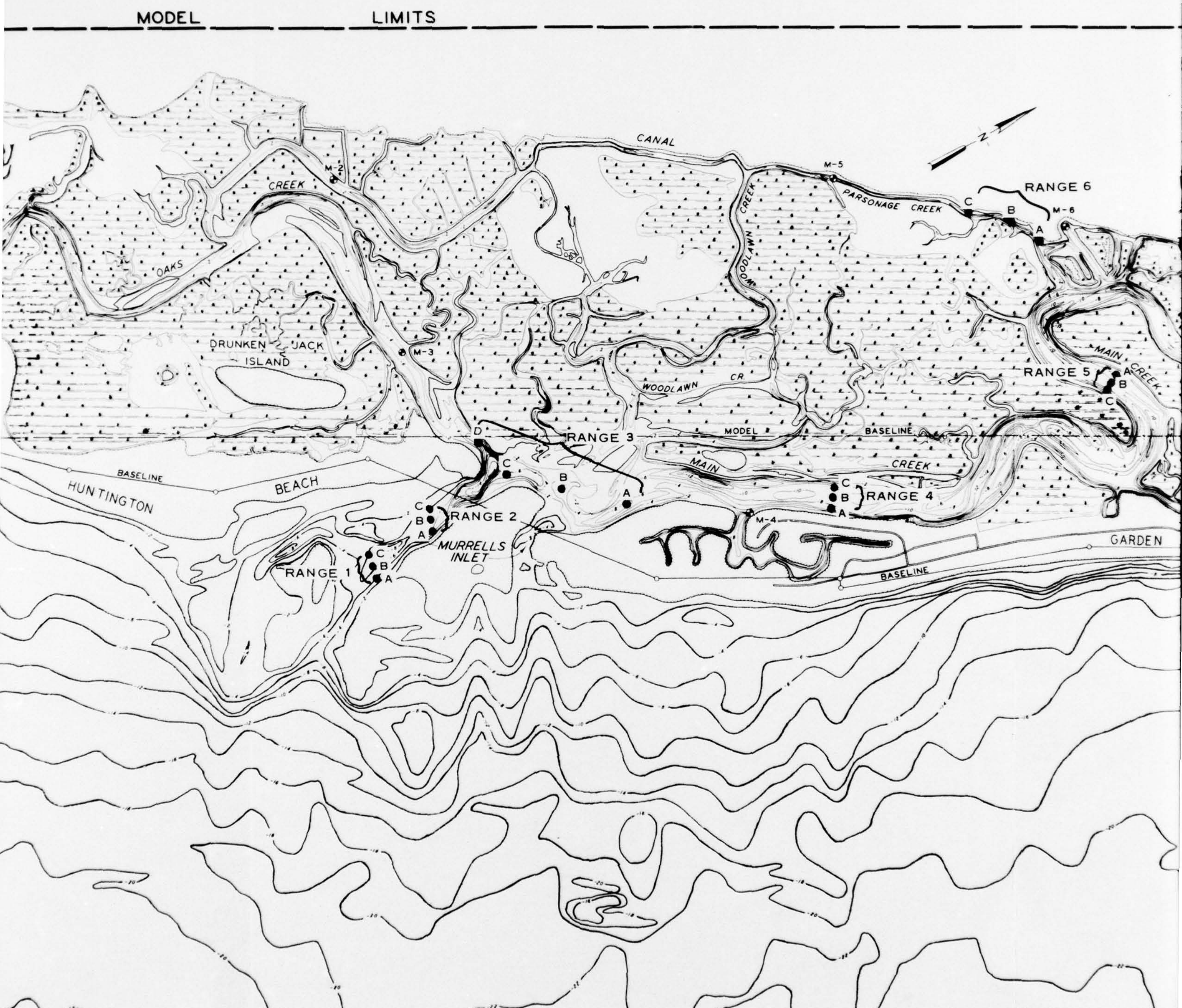

MODEL
LIMITS
MODEL
CANAL
M-2
CREEK
M-5
PARSONAGE CREEK
M-6
OAKS
WOODLAWN CREEK
DRUNKEN JACK ISLAND
M-3
WOODLAWN CR
MAIN CR
MAIN CREEK
MODEL BASELINE
WHALE
MAIN CREEK
BASELINE
BEACH
NGTON
M-4
MURRELLS INLET
GARDEN
BASELINE
M-8
LEGEND
PROTOTYPE GAGING STATION

EXISTING CONDITIONS
MARCH - MAY 1974

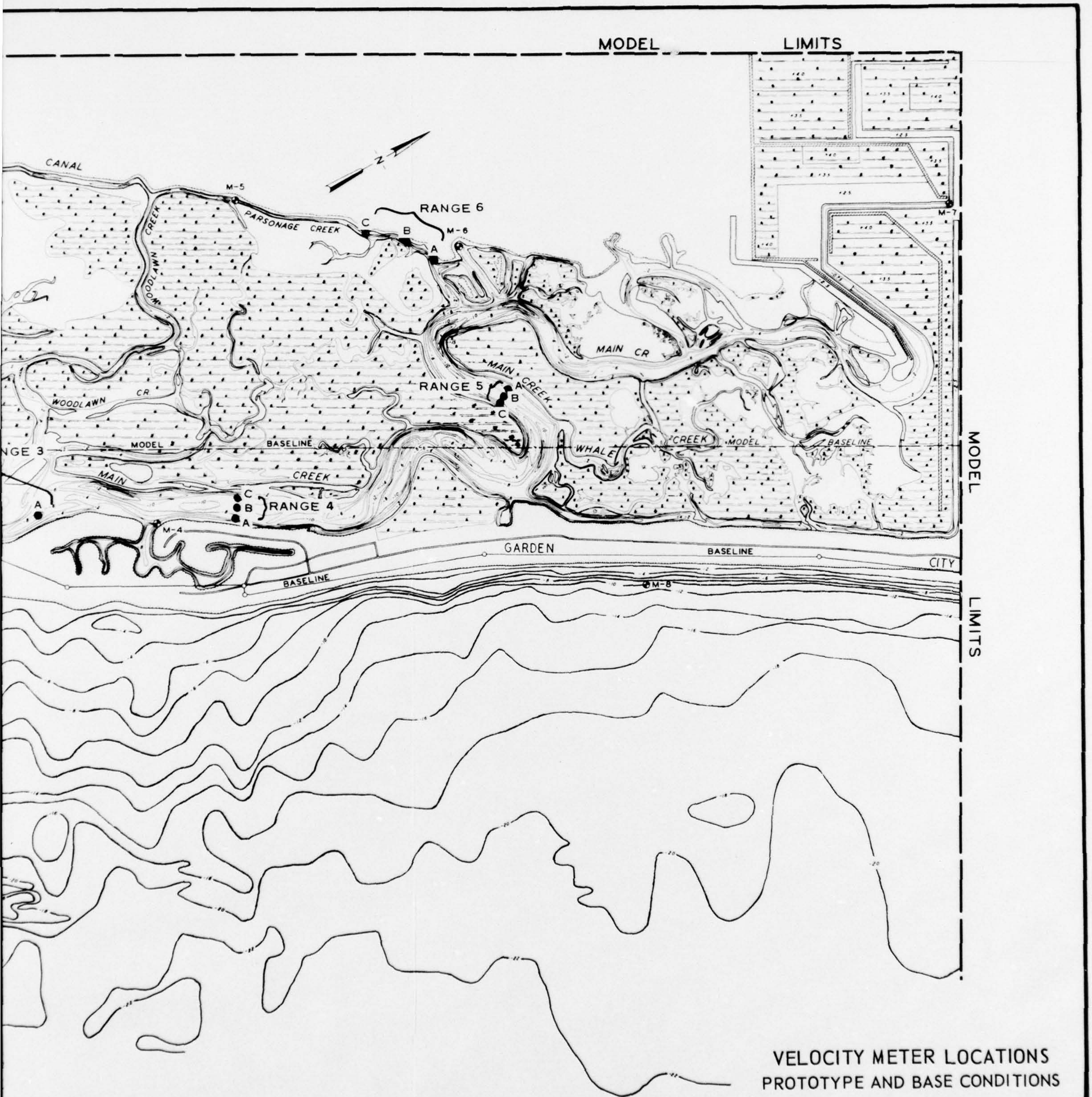
3

PLATE 1

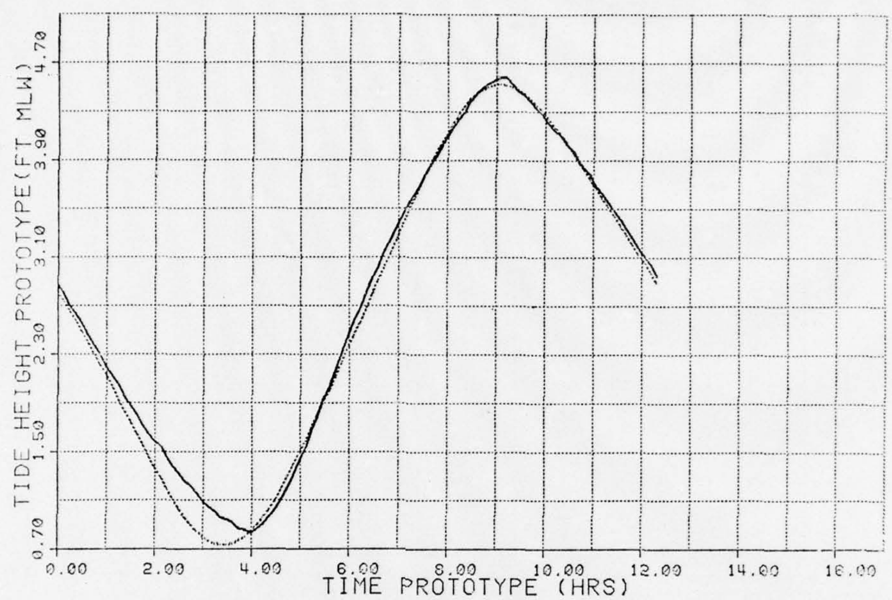

MODEL LIMITS
MODEL LIMITS
OAKS CREEK
M-1
M-2
M-3
CREEK
OAKS
DRUNKEN JACK ISLAND
HUNTINGTON BASELINE BEACH
MODEL BASELINE
BASELINE
HUNTINGTON BEACH
RANGE 1
A
B
C
MURR
INL
SCALE IN FEET
500 0 500 1000
LEGEND
3A VELOCITY METER LOCATION



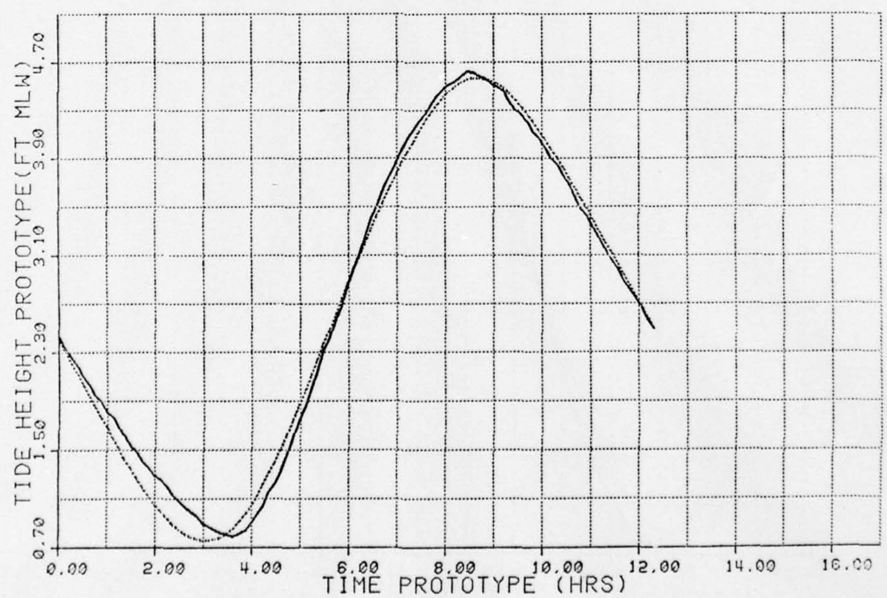
MODEL LIMITS
CANAL
CREEK
OAKS
M-2
M-3
M-4
M-5
M-6
DRUNKEN JACK ISLAND
WOODLAWN CREEK
PARSONAGE CREEK
WOODLAWN CR.
RANGE 6
RANGE 5
RANGE 4
RANGE 3
RANGE 2
RANGE 1
MAIN CREEK
MODEL BASELINE
BASELINE
HUNTINGTON BEACH
MURRELLS INLET
GARDEN
N
LEGEND
3A VELOCITY METER LOCATION



VELOCITY METER LOCATIONS
PROTOTYPE AND BASE CONDITIONS



GAGE 1



GAGE 2

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

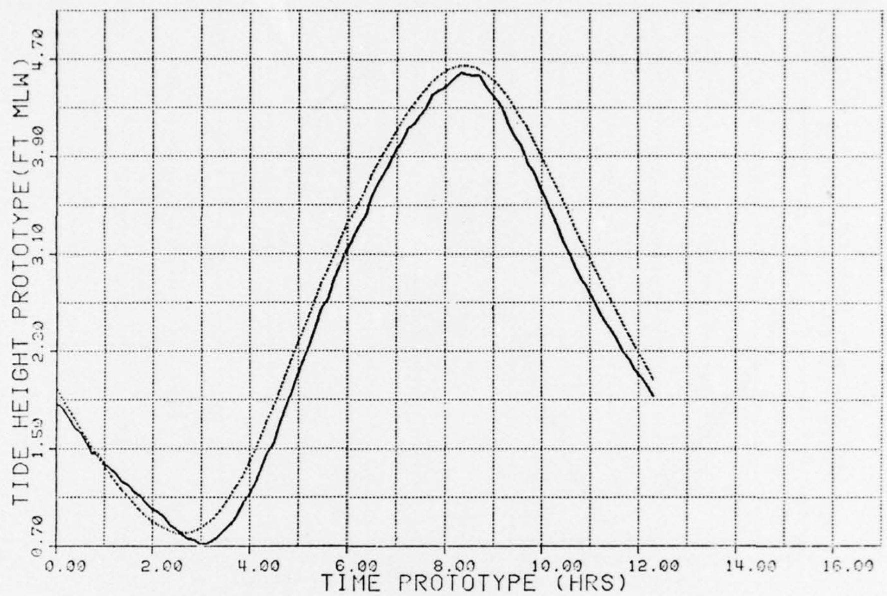
LEGEND

.... PROTOTYPE

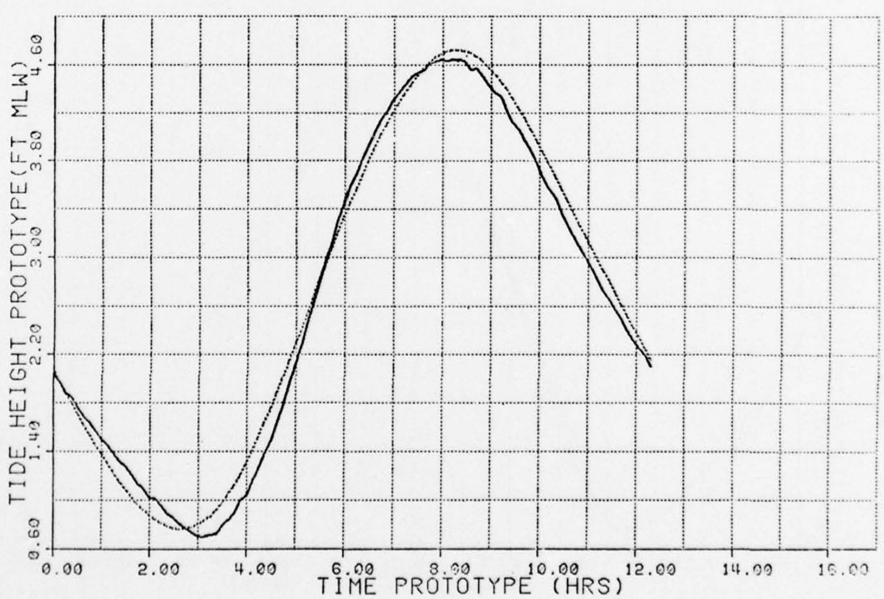
——— MODEL

VERIFICATION OF TIDAL ELEVATIONS

GAGES 1 AND 2



GAGE 3



GAGE 4

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

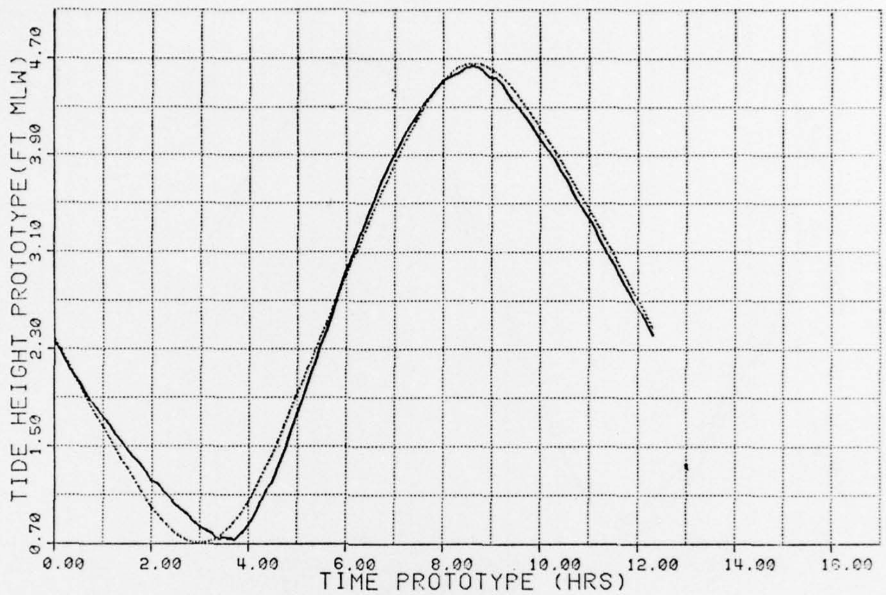
LEGEND

PROTOTYPE

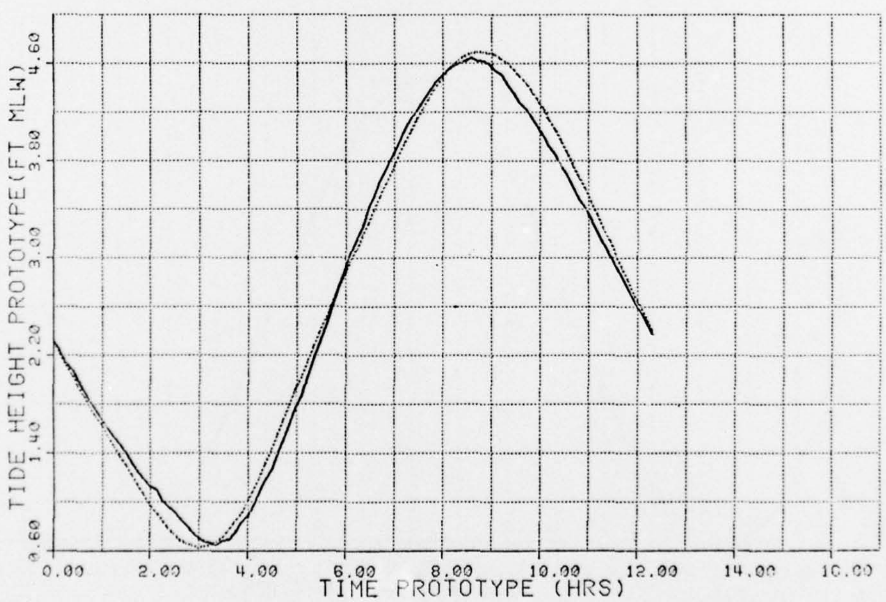
MODEL

VERIFICATION OF TIDAL ELEVATIONS

GAGES 3 AND 4



GAGE 5



GAGE 6

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

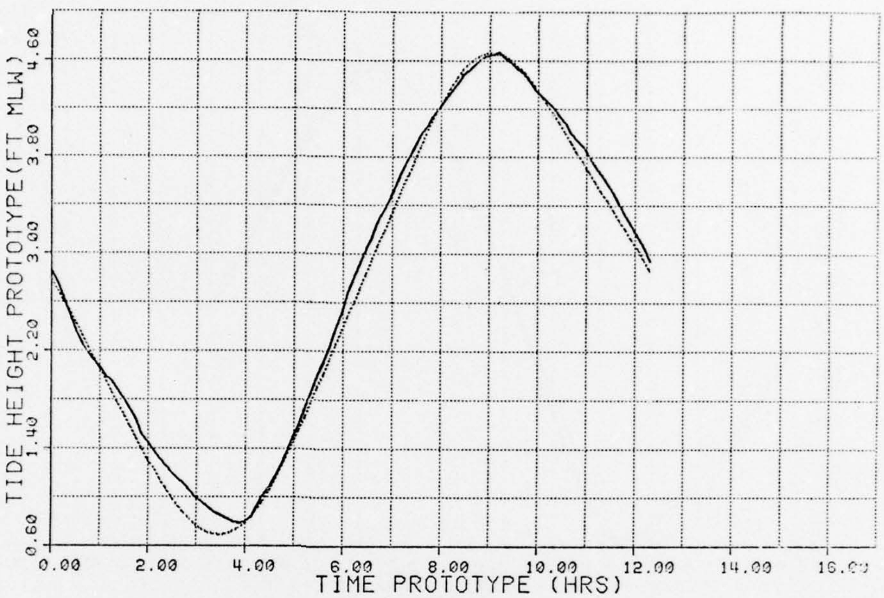
LEGEND

PROTOTYPE

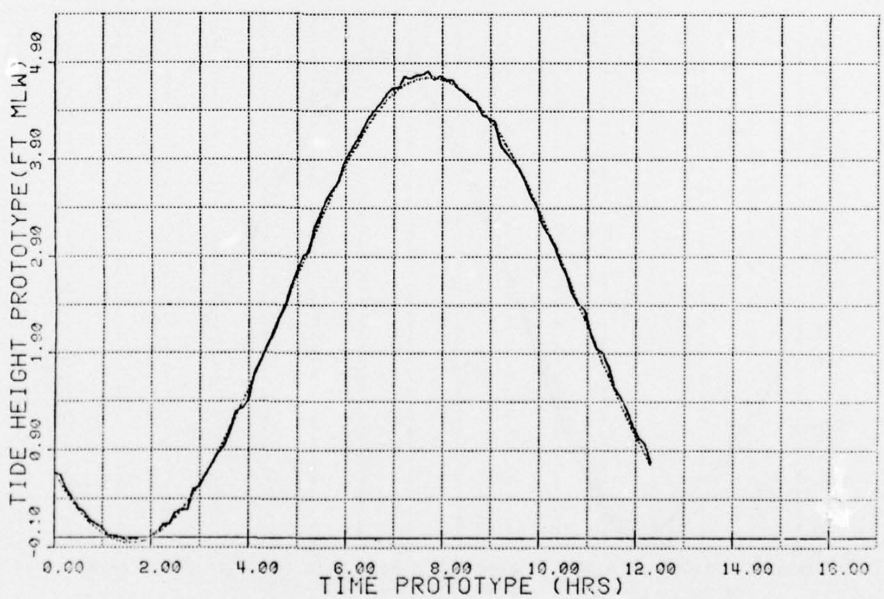
MODEL

VERIFICATION OF TIDAL ELEVATIONS

GAGES 5 AND 6



GAGE 7



GAGE 8

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

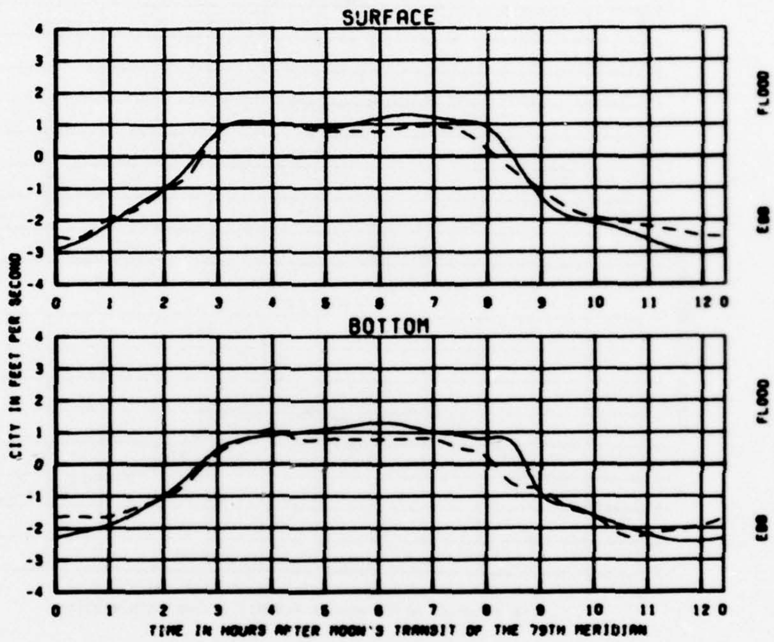
LEGEND

PROTOTYPE

MODEL

VERIFICATION OF TIDAL ELEVATIONS

GAGES 7 AND 8

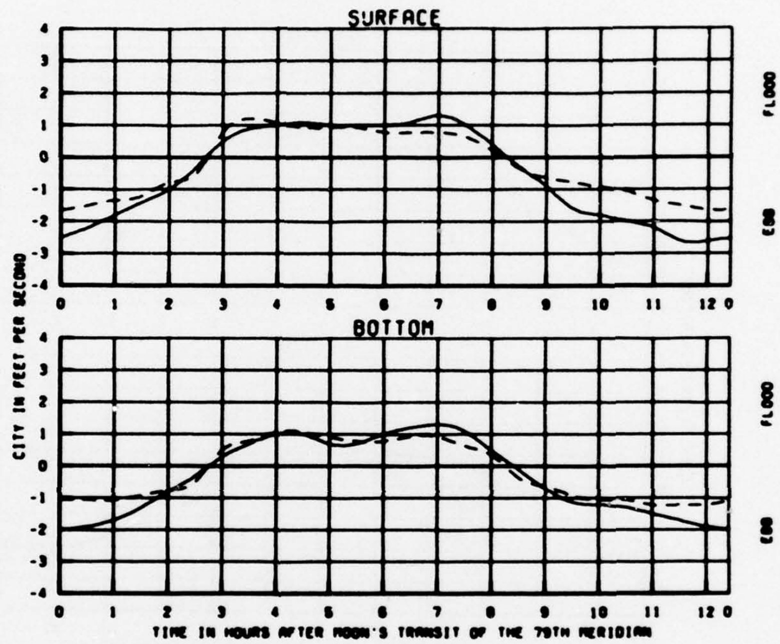


TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME = 0961 HOURS EDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE = 6.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
PROTOTYPE ———
MODEL - - -

VERIFICATION OF MODEL VELOCITIES

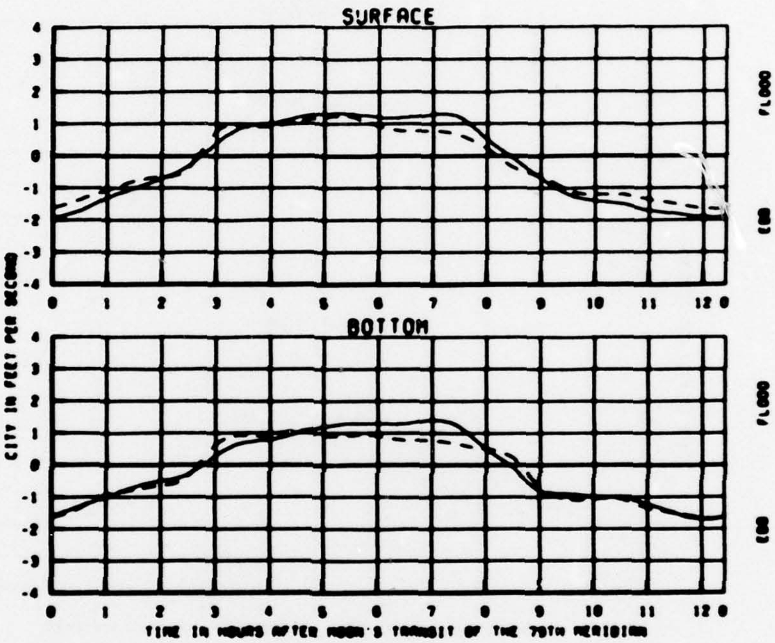
STATION 1A



TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME = 0961 HOURS EDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE = 6.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.0 FEET

LEGEND
PROTOTYPE
MODEL

VERIFICATION
OF MODEL
VELOCITIES
STATION
10



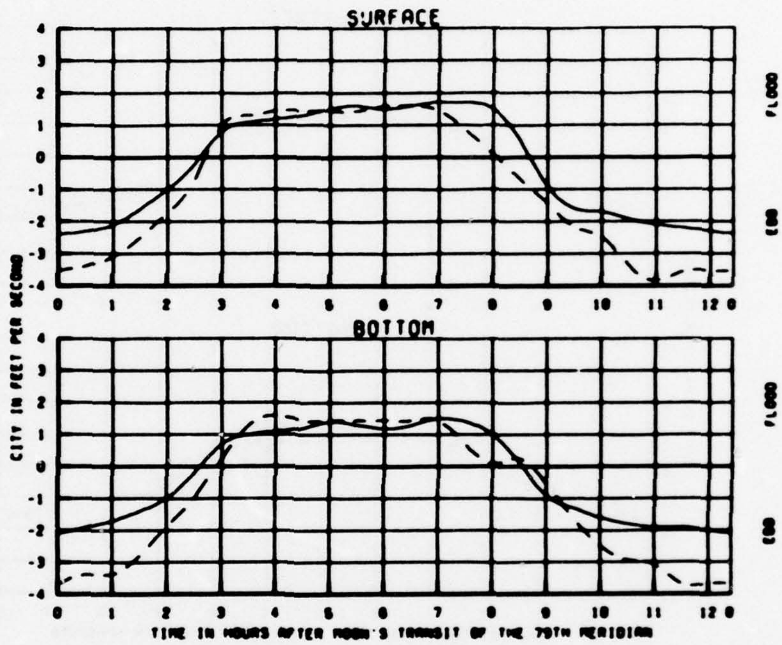
TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME = 0051 HOURS EDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE = 6.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.0 FEET

LEGEND
PROTOTYPE ———
MODEL – – –

VERIFICATION
OF MODEL
VELOCITIES

STATION
1C

PLATE 9



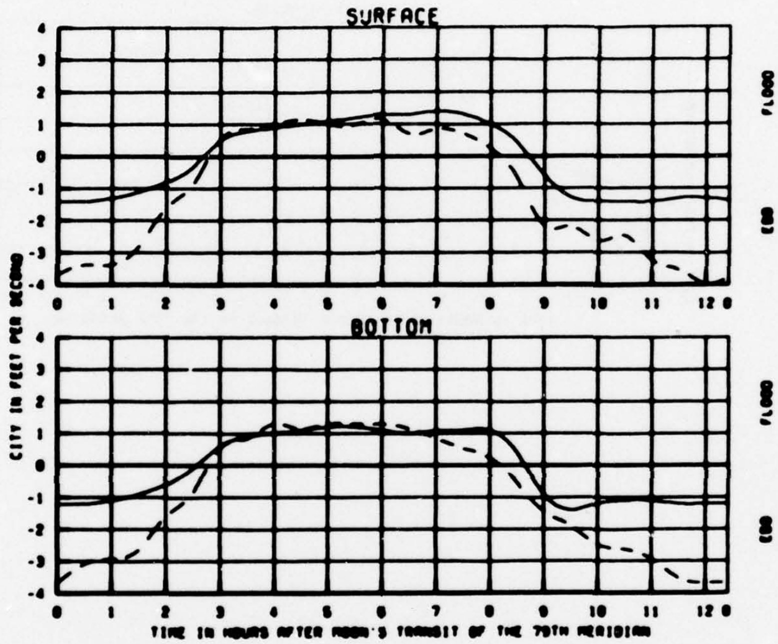
TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME = 0951 HOURS EDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE = 6.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.0 FEET

LEGEND
PROTOTYPE ———
MODEL – – –

VERIFICATION
OF MODEL
VELOCITIES

STATION
2A

PLATE 10

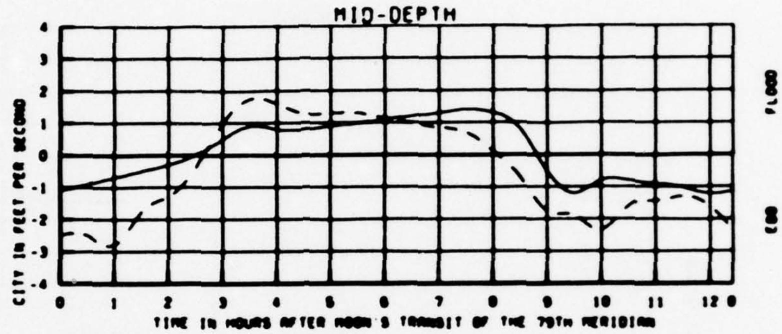


TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME = 0061 HOURS EDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE = 6.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.0 FEET

LEGEND
PROTOTYPE ———
MODEL – – –

VERIFICATION
OF MODEL
VELOCITIES

STATION
2B

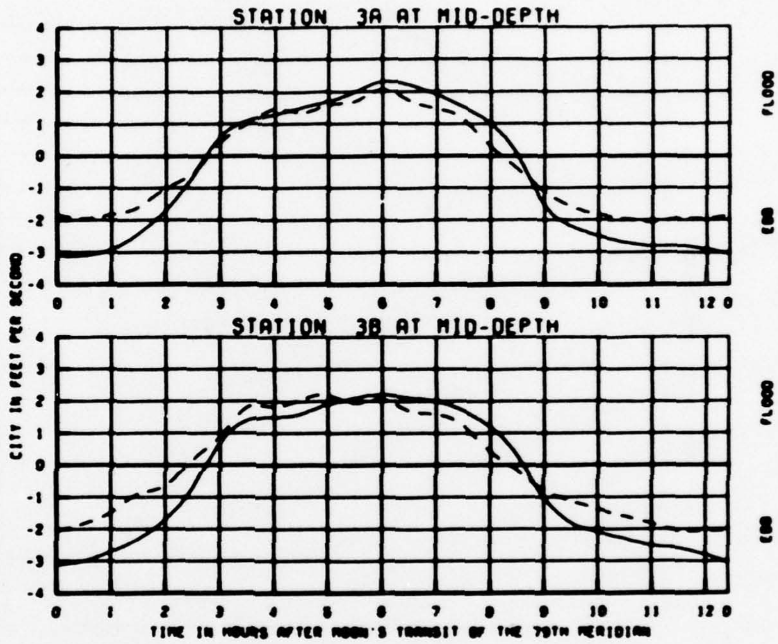


TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME : 0951 HOURS EDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE : 6.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

LEGEND
PROTOTYPE ———
MODEL – – –

VERIFICATION
OF MODEL
VELOCITIES

STATION
2C



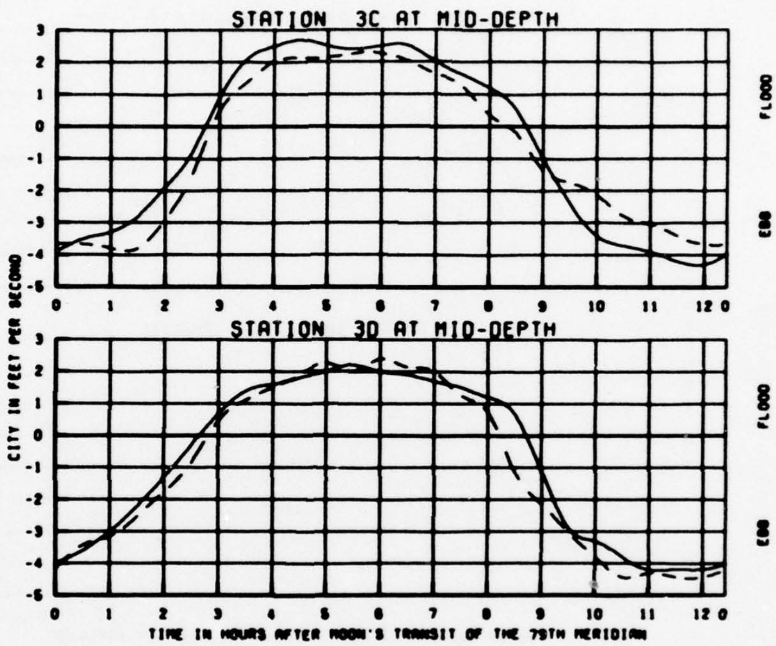
TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME = 0951 HOURS EDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE = 6.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.0 FEET

LEGEND
PROTOTYPE ———
MODEL — — —

VERIFICATION OF MODEL VELOCITIES

STATIONS 3A AND 3B

PLATE 13



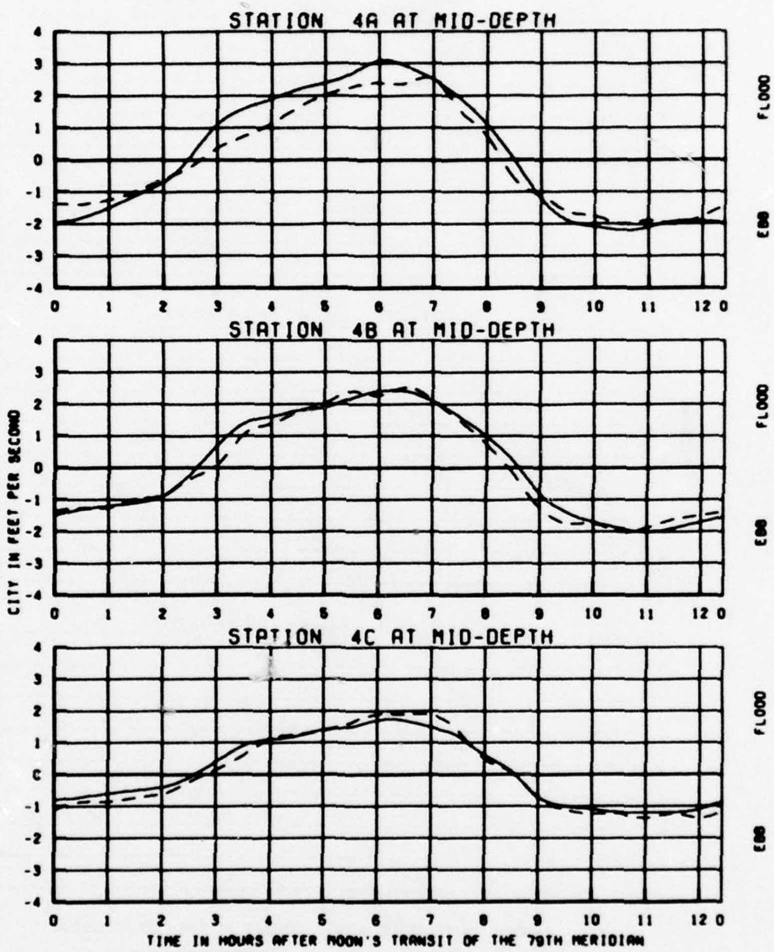
TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME = 0961 HOURS EDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE = 6.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
PROTOTYPE ———
MODEL – – –

VERIFICATION
OF MODEL
VELOCITIES

STATIONS
3C AND 3D

PLATE 14



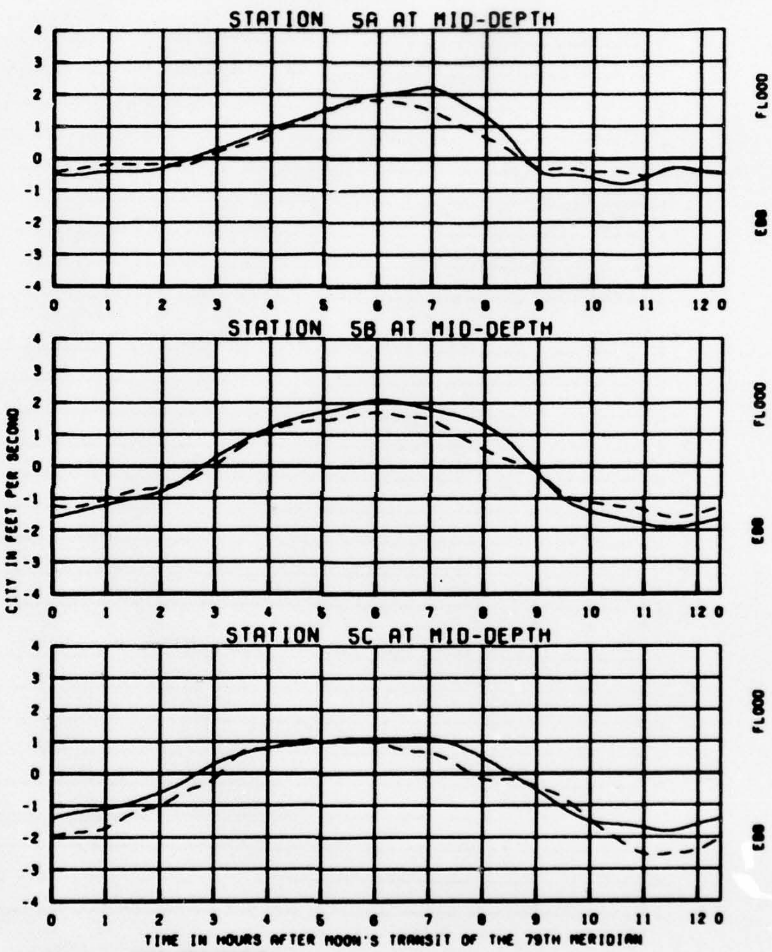
TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME = 0961 HOURS EDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE = 6.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
PROTOTYPE ———
MODEL - - -

VERIFICATION
OF MODEL
VELOCITIES

STATIONS
4A, 4B, AND 4C

PLATE 15



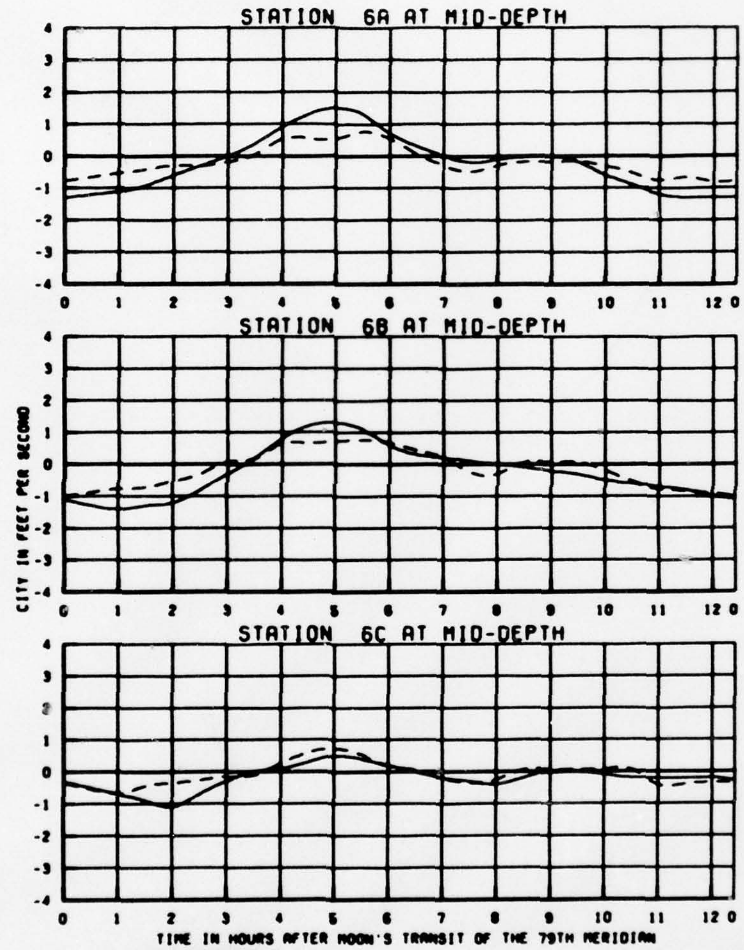
TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME = 0961 HOURS FDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE = 6.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
PROTOTYPE ———
MODEL – – –

VERIFICATION
OF MODEL
VELOCITIES

STATIONS
5A, 5B, AND 5C

PLATE 16

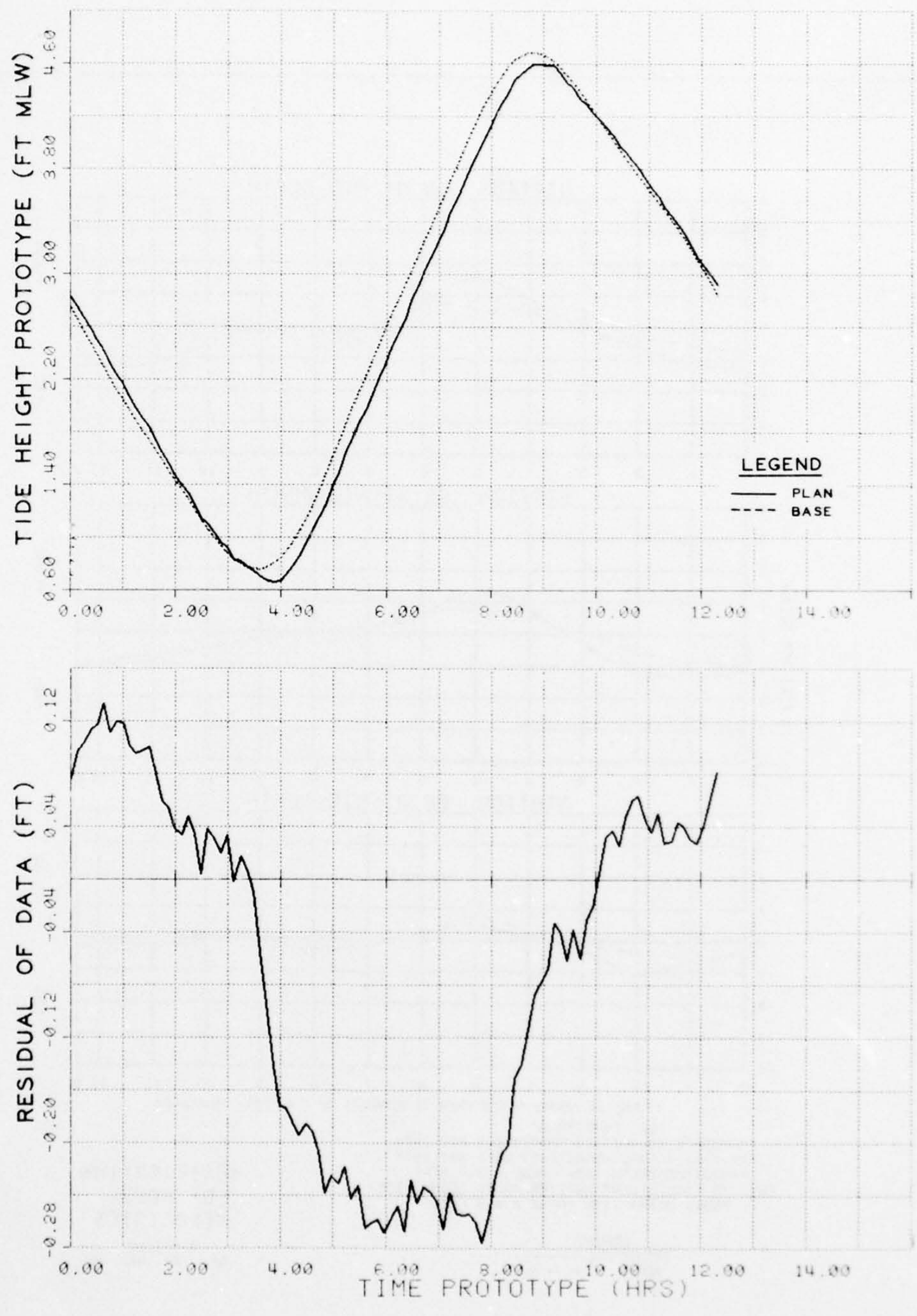


TEST CONDITIONS
PROTOTYPE VELOCITIES OBTAINED 2 MAY 1974
ZERO TIME = 0951 HOURS EDST ON 2 MAY 1974
PROTOTYPE OCEAN TIDE RANGE = 8.0 FEET
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
PROTOTYPE ———
MODEL – – –

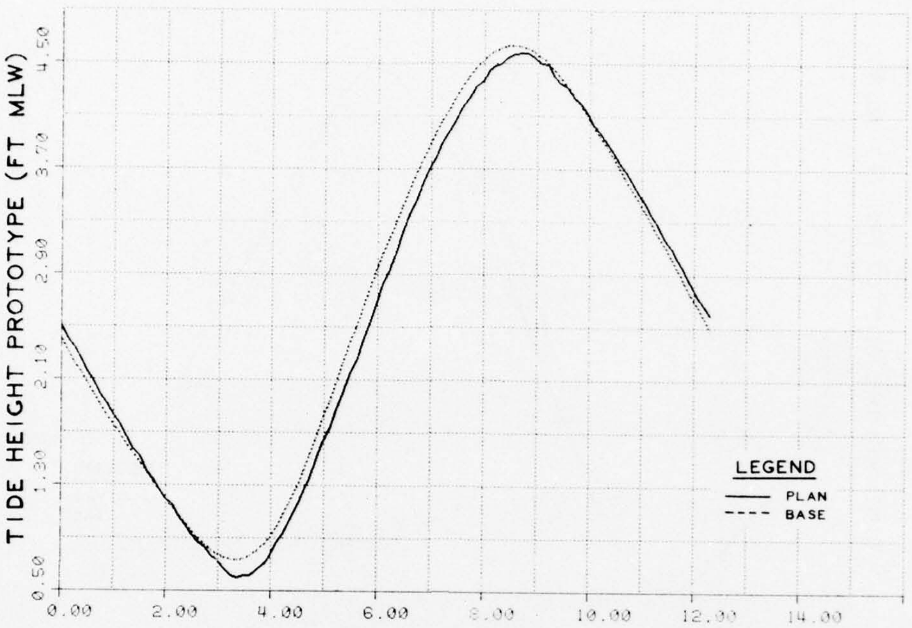
VERIFICATION
OF MODEL
VELOCITIES

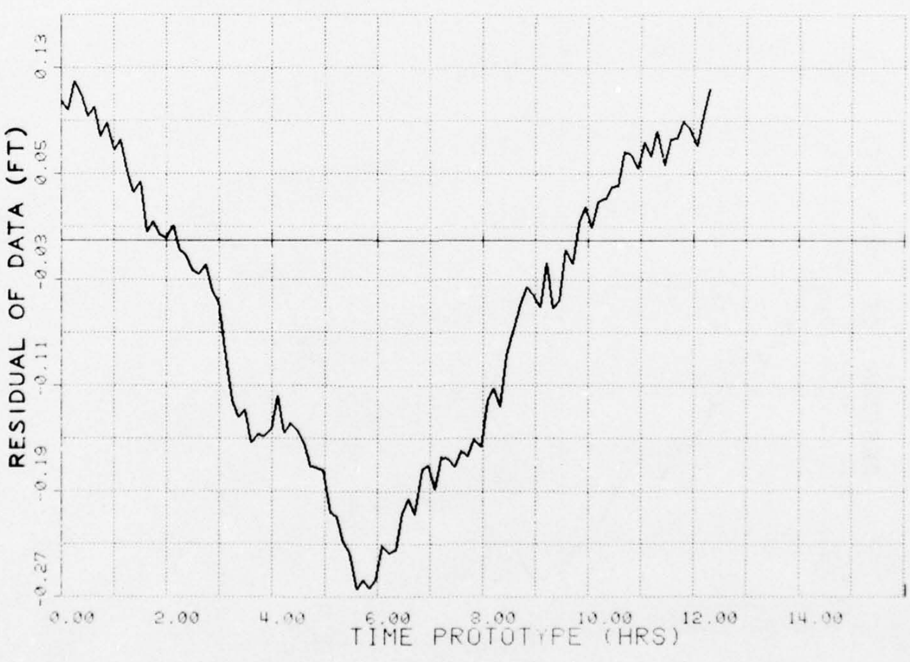
STATIONS
6A, 6B, AND 6C



NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

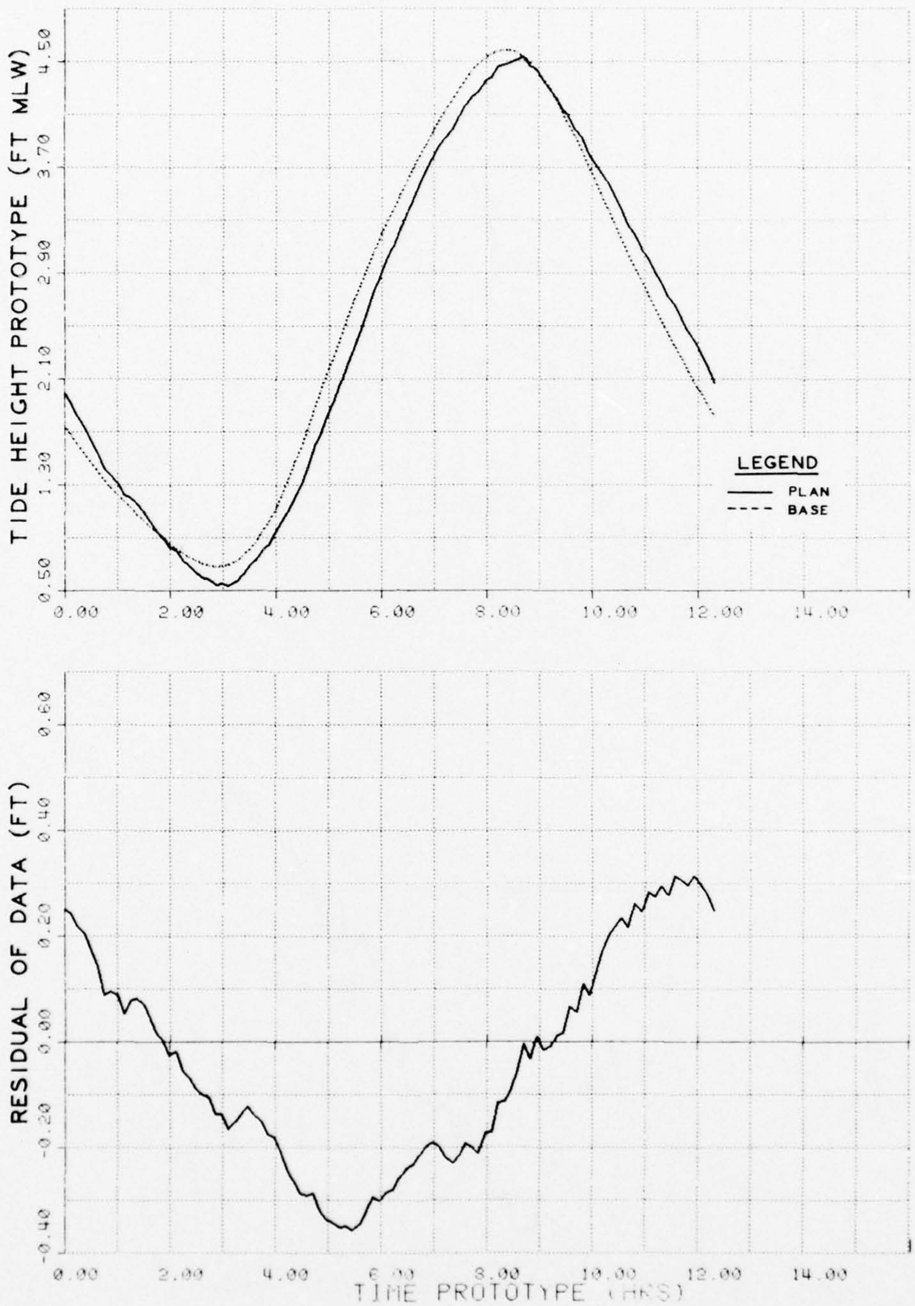
TIDAL ELEVATIONS
COMPARISON OF
PLAN 1 TO BASE
GAGE 1





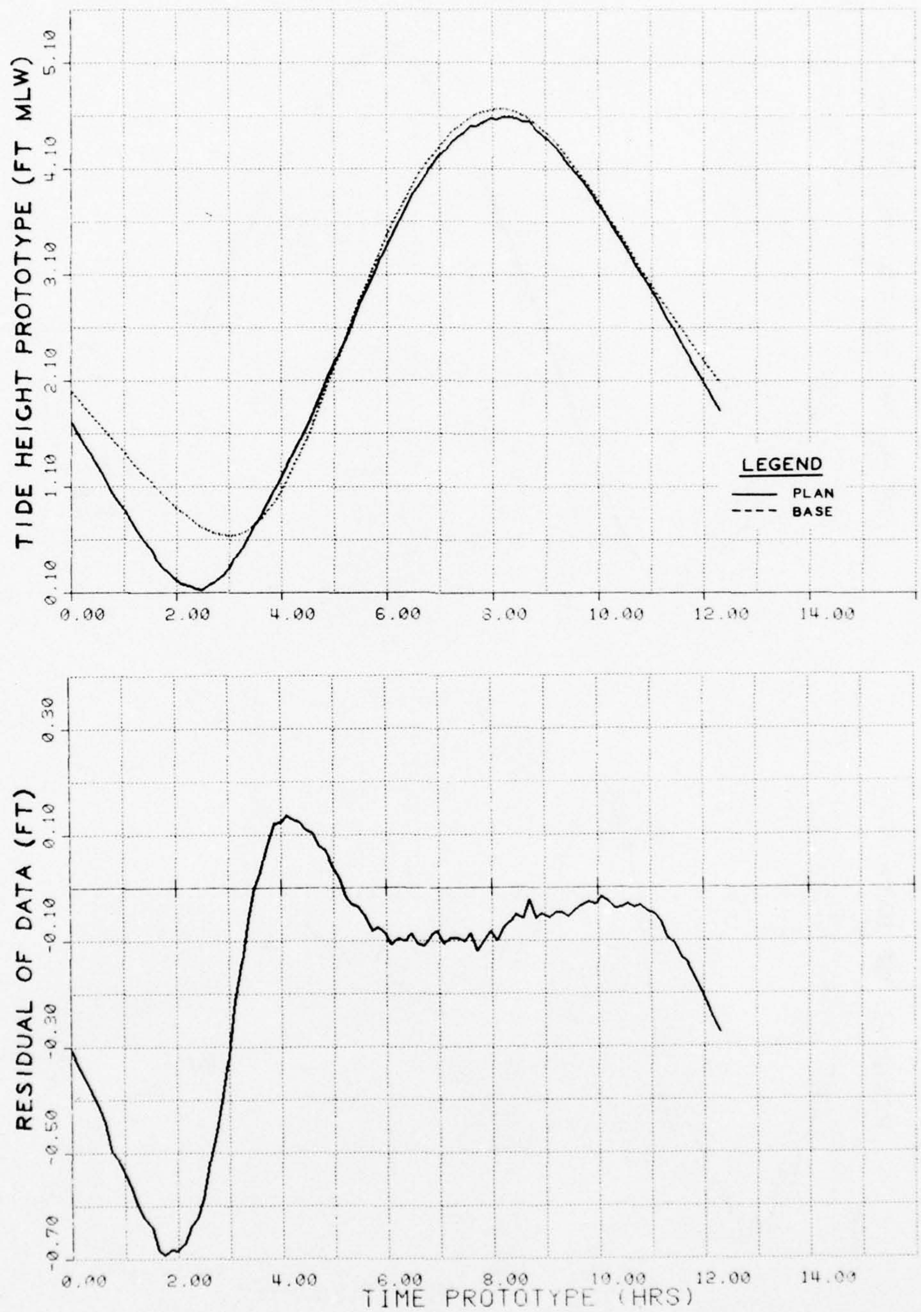
NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 1 TO BASE
GAGE 2



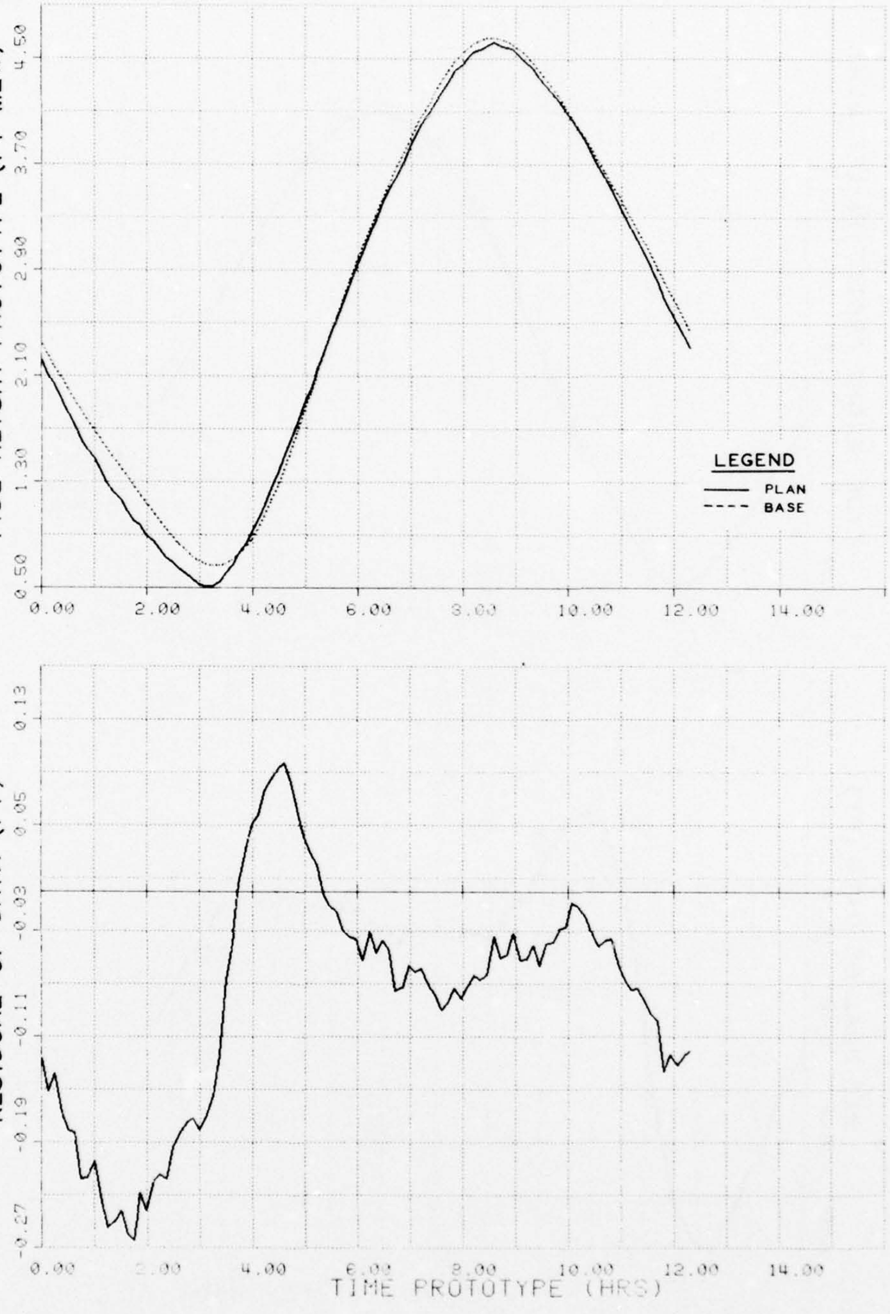
NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 1 TO BASE
GAGE 3



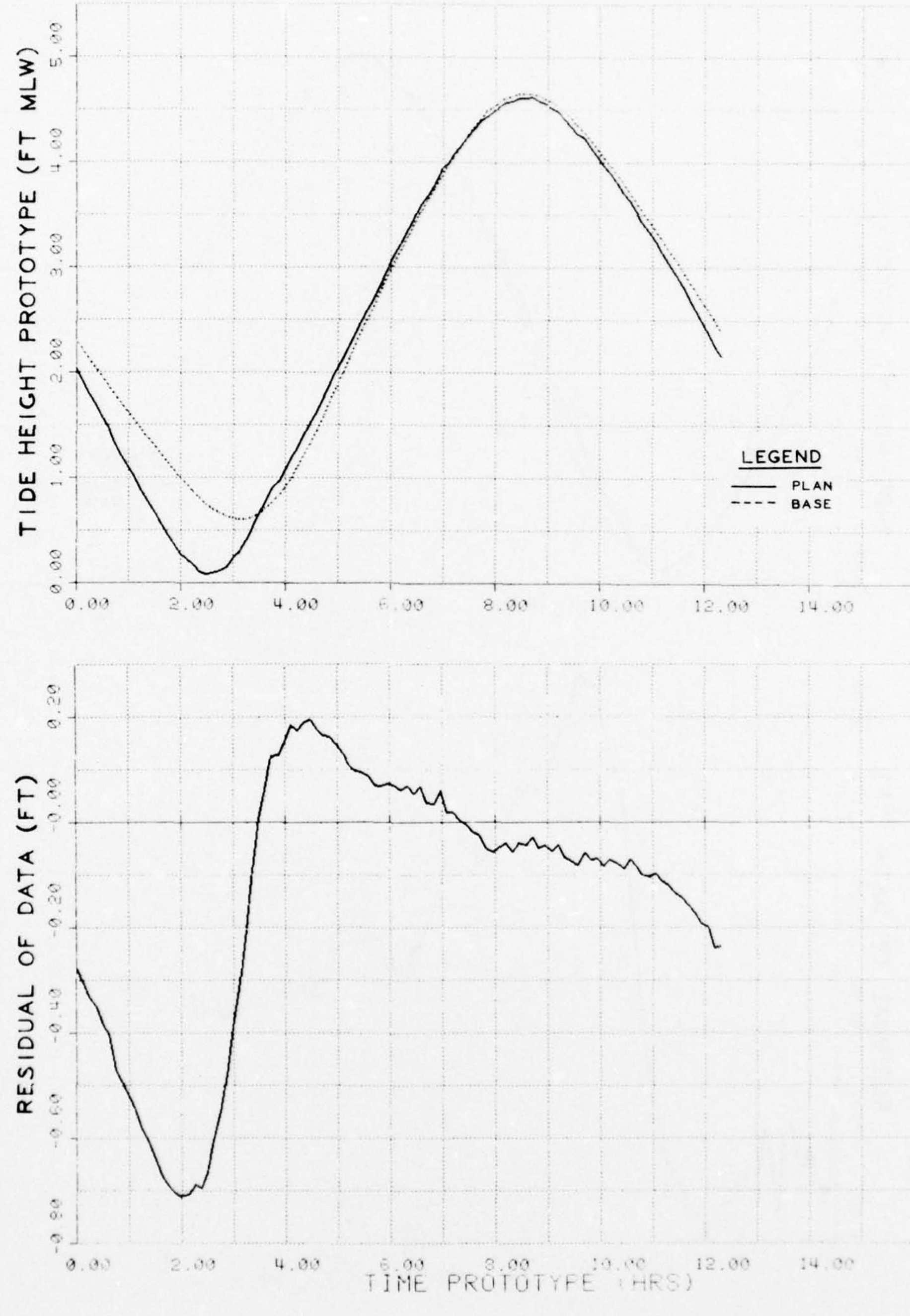
NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF PLAN 1 TO BASE
GAGE 4



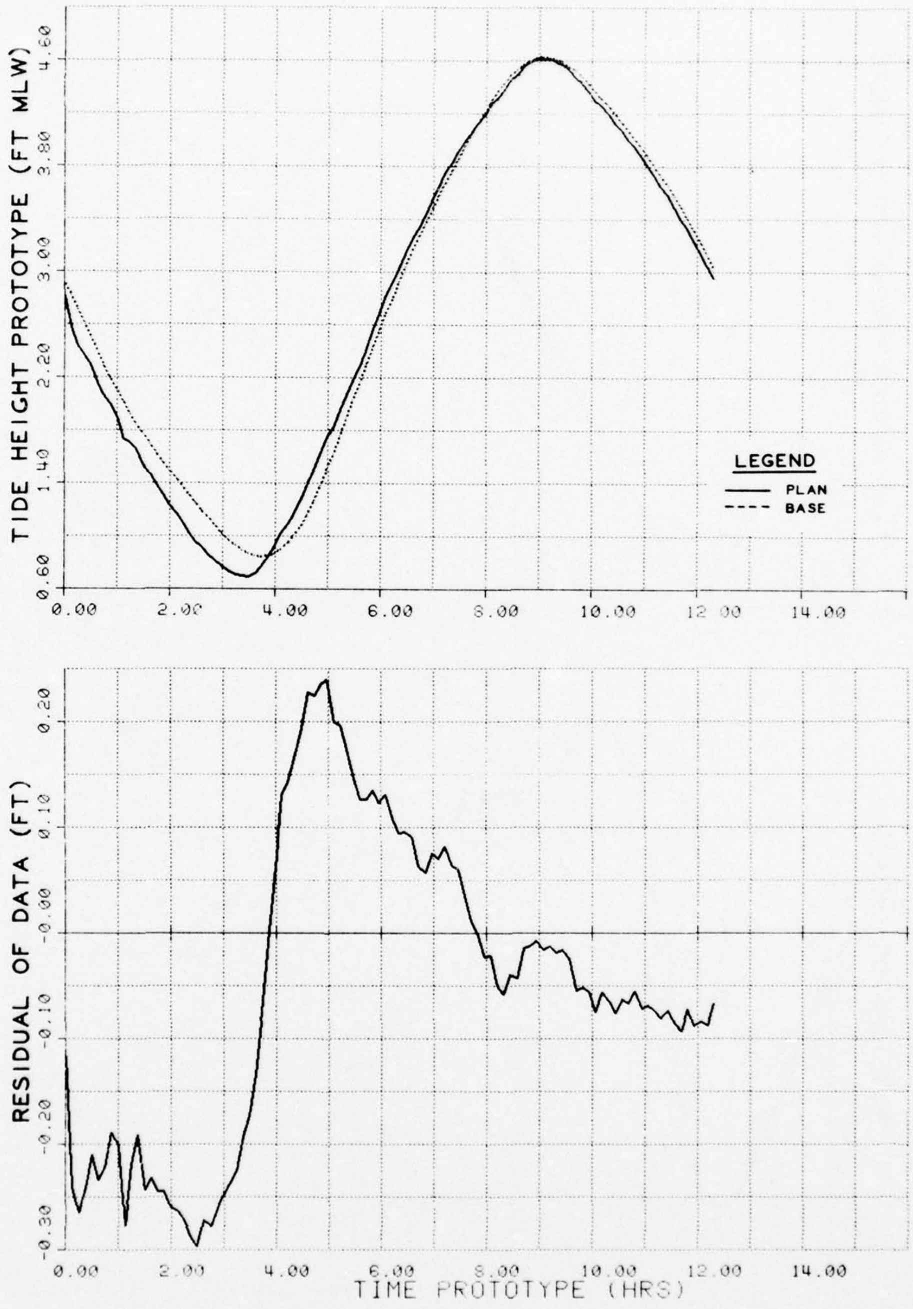
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 1 TO BASE
GAGE 5



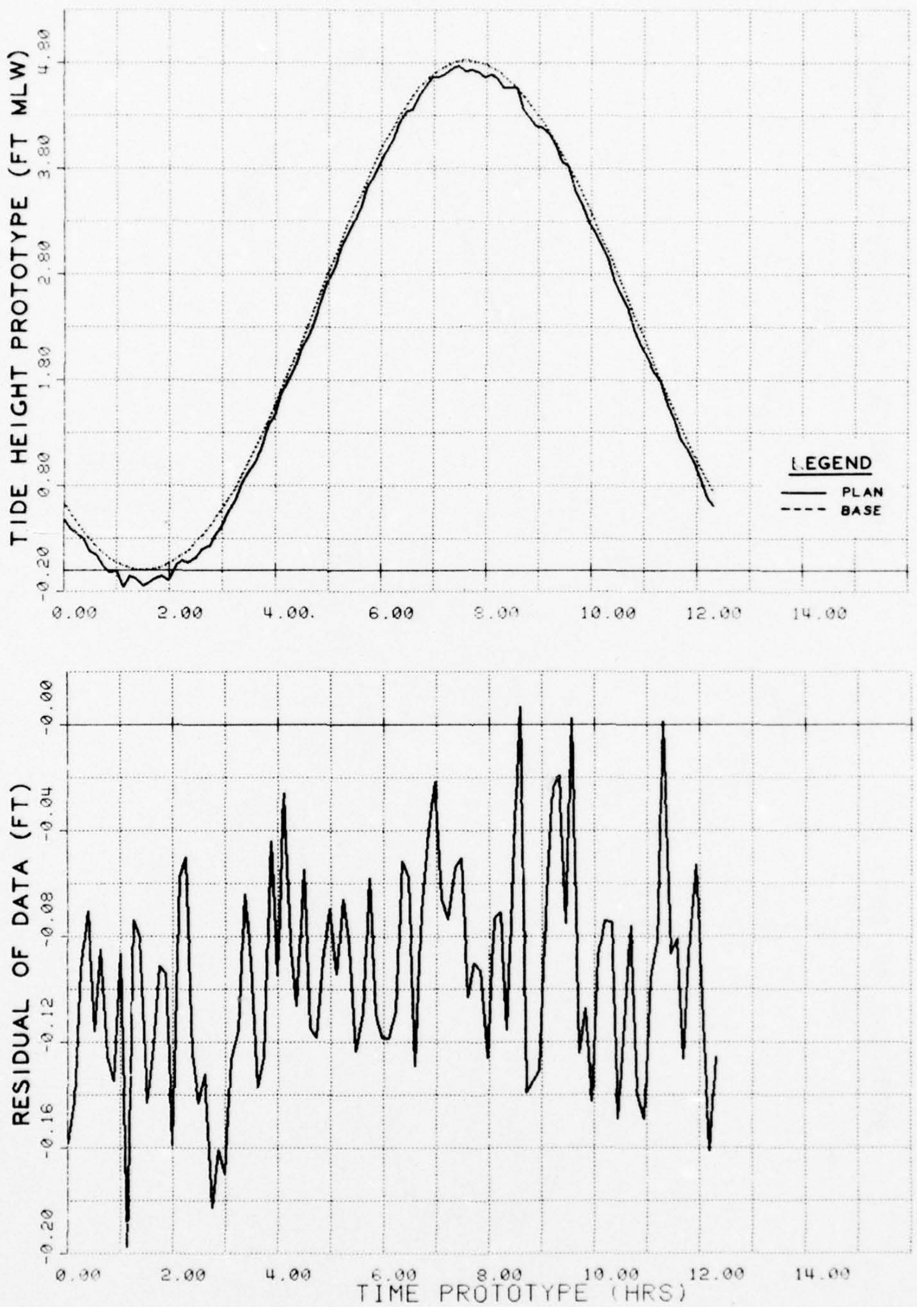
NOTE: RESIDUAL= PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 1 TO BASE
GAGE 6



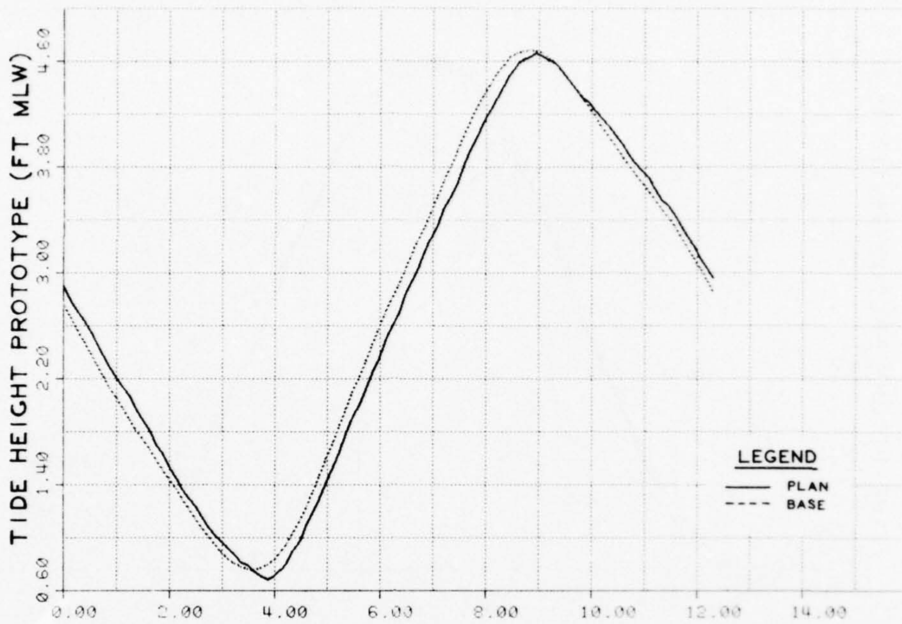
NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 1 TO BASE
GAGE 7



NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

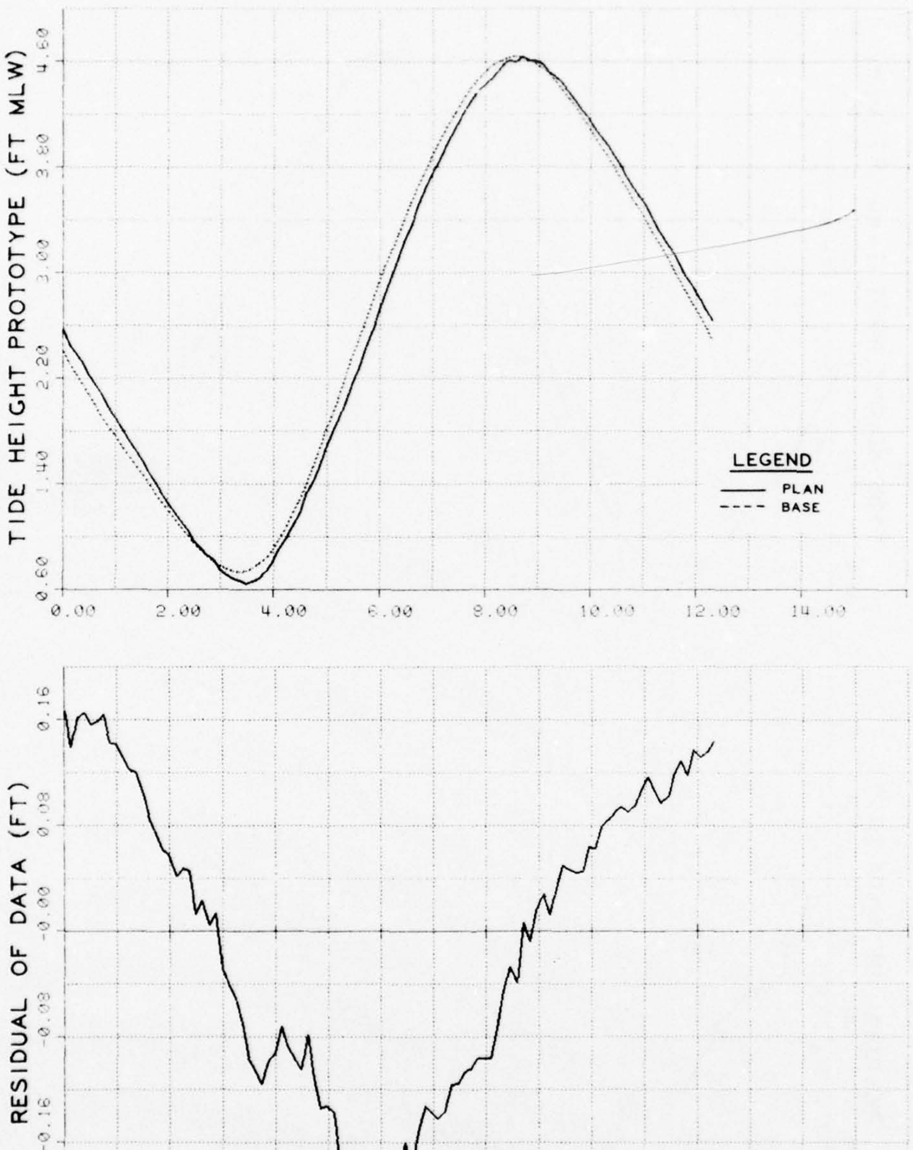
TIDAL ELEVATIONS
COMPARISON OF
PLAN 1 TO BASE
GAGE 8



NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

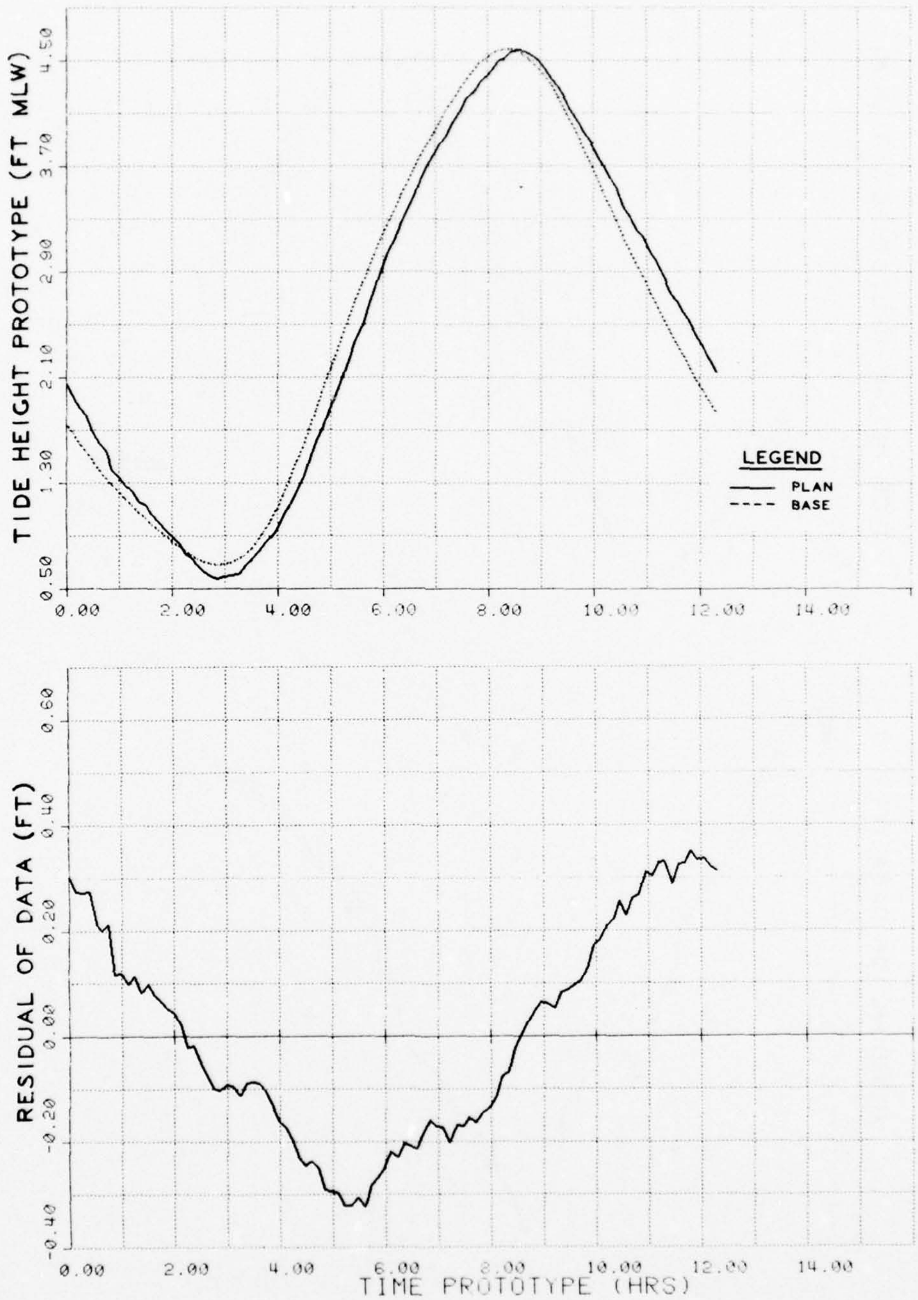
TIDAL ELEVATIONS
COMPARISON OF PLAN 2 TO BASE

GAGE 1



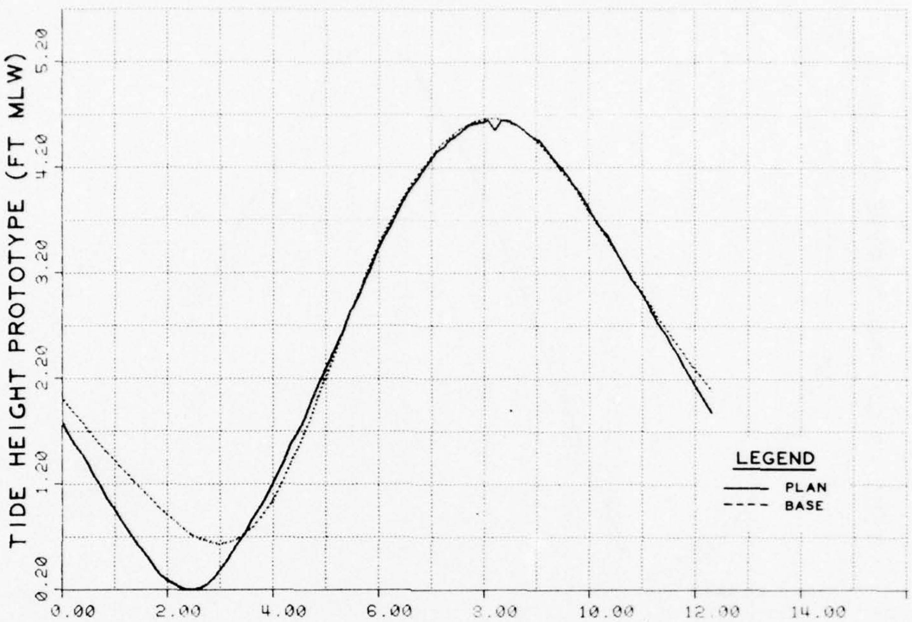
NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

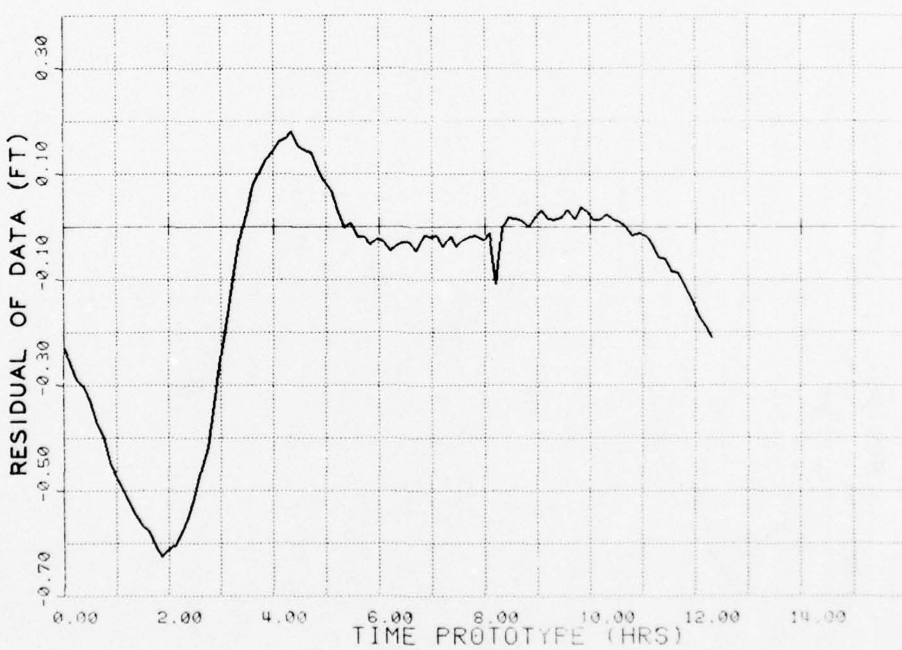
TIDAL ELEVATIONS
COMPARISON OF
PLAN 2 TO BASE
GAGE 2



NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

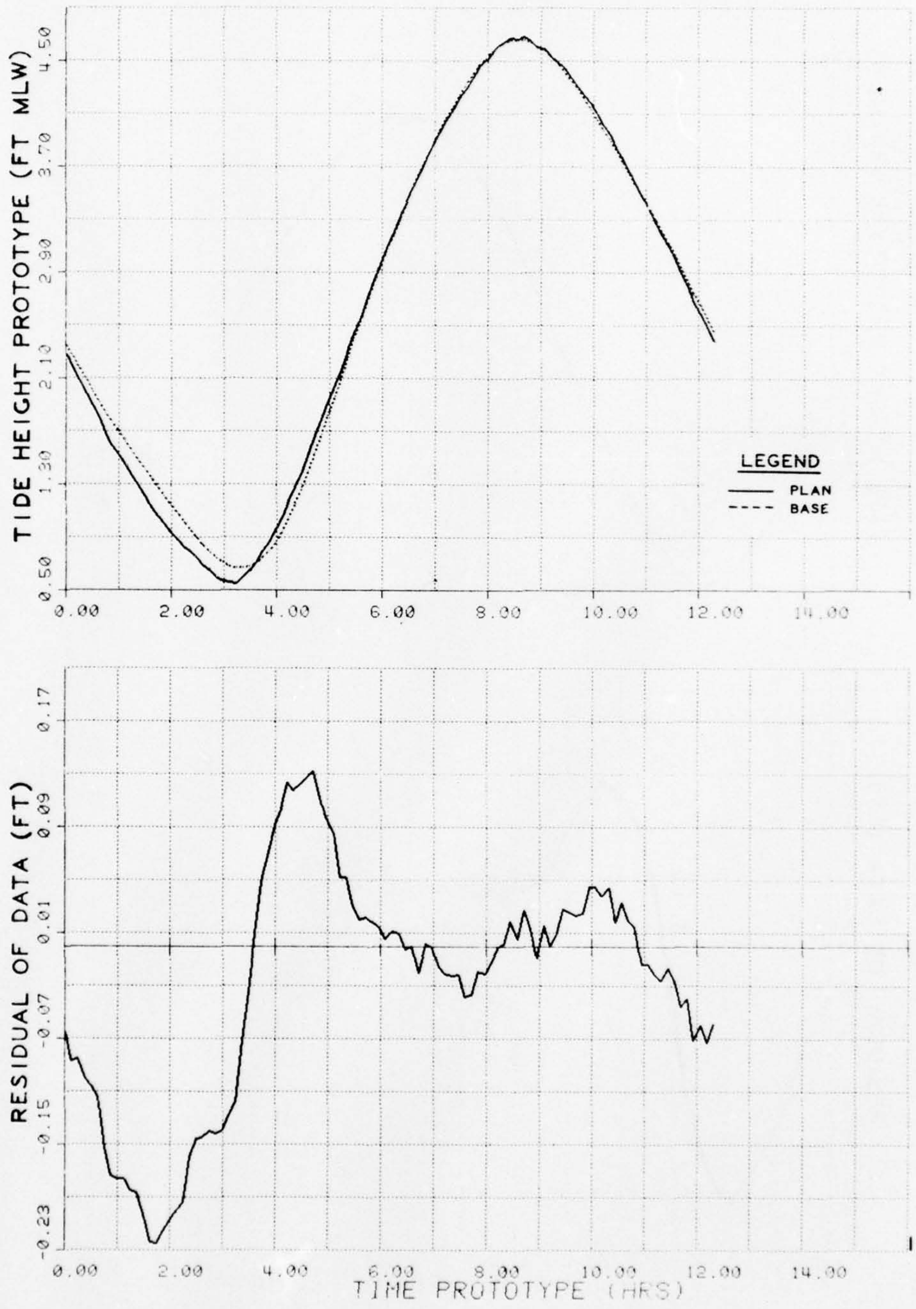
TIDAL ELEVATIONS
COMPARISON OF
PLAN 2 TO BASE
GAGE 3





NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

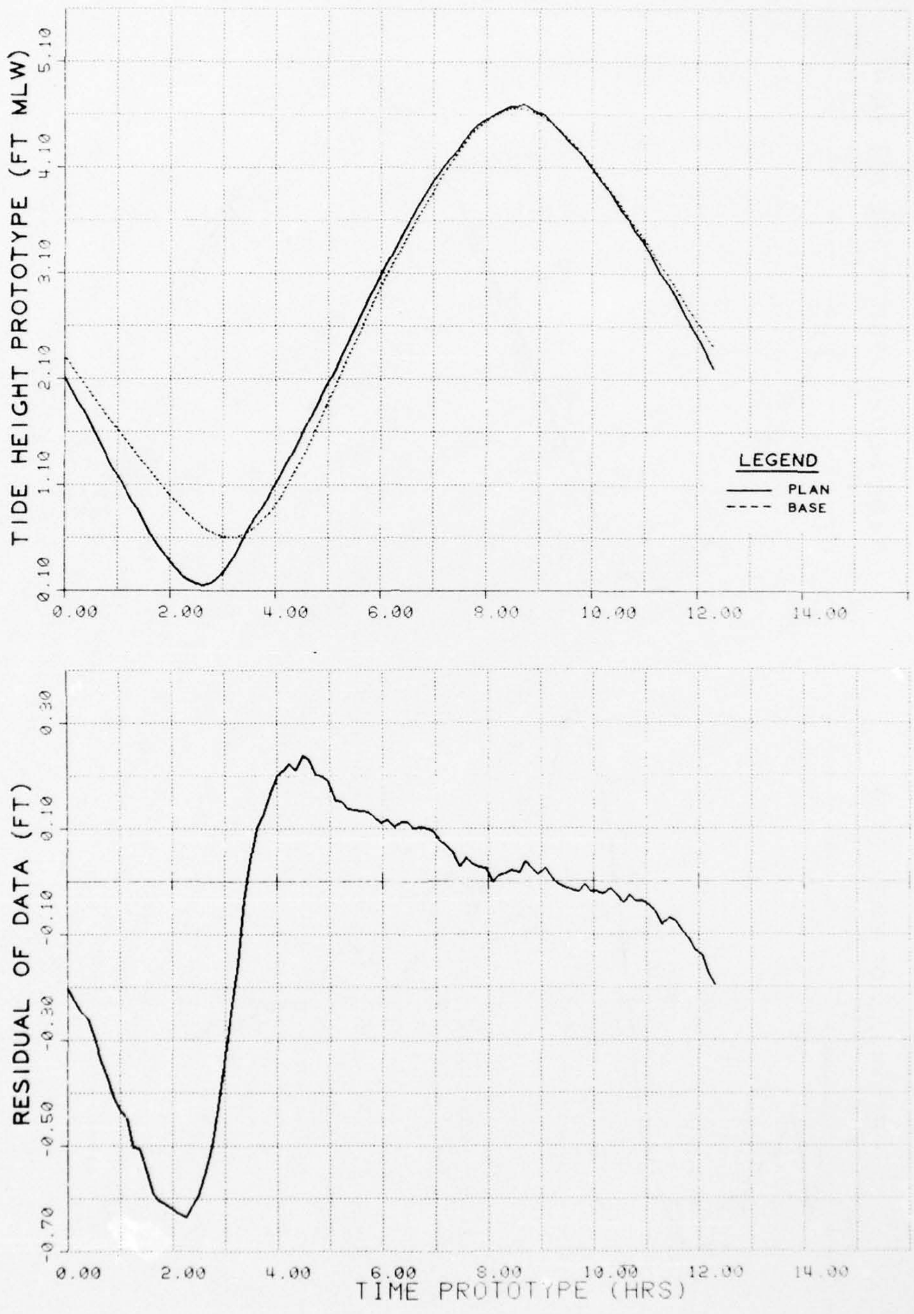
TIDAL ELEVATIONS
COMPARISON OF PLAN 2 TO BASE
GAGE 4



NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

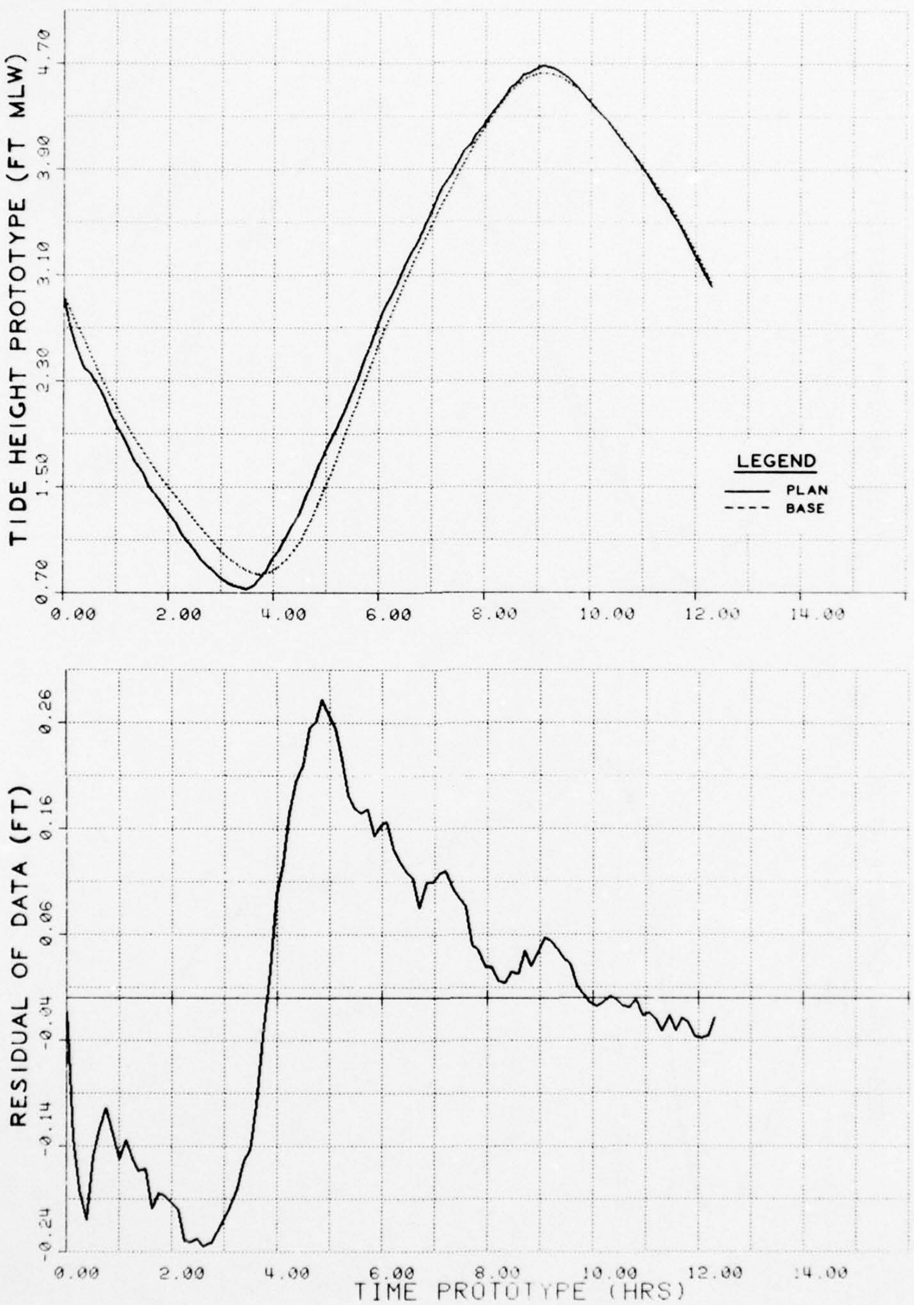
TIDAL ELEVATIONS
COMPARISON OF
PLAN 2 TO BASE
GAGE 5

PLATE 30



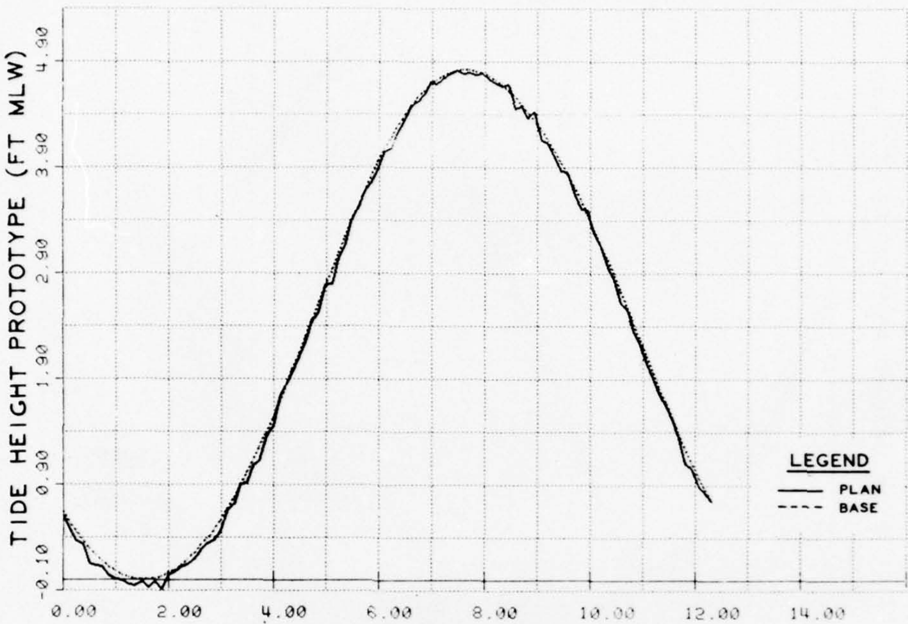
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 2 TO BASE
GAGE 6



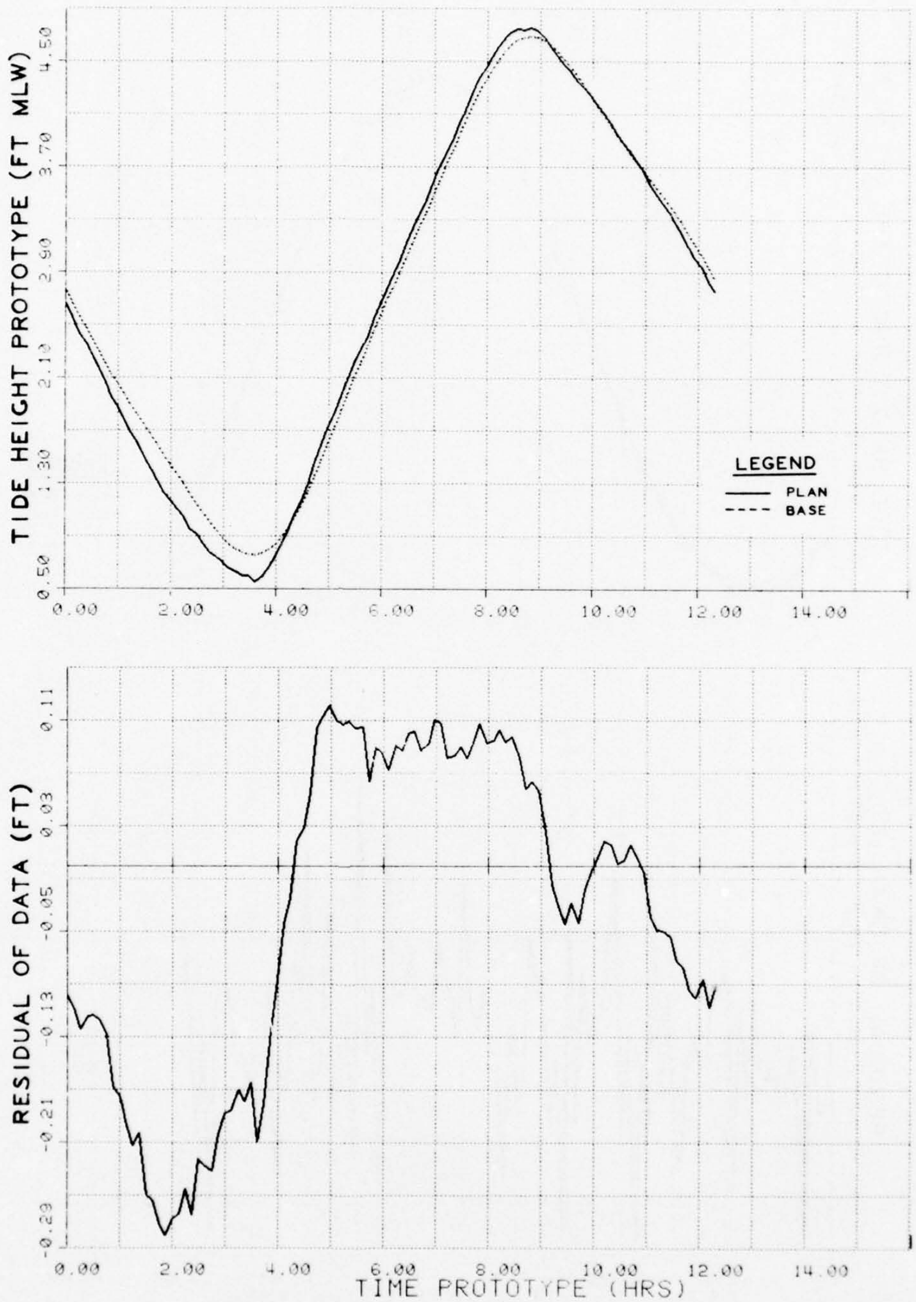
NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF PLAN 2 TO BASE
GAGE 7



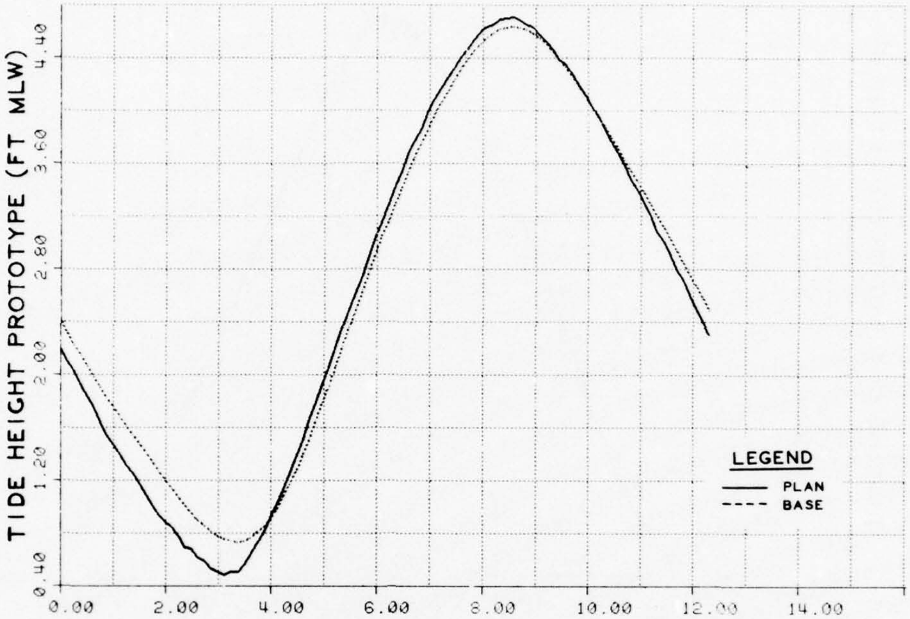
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

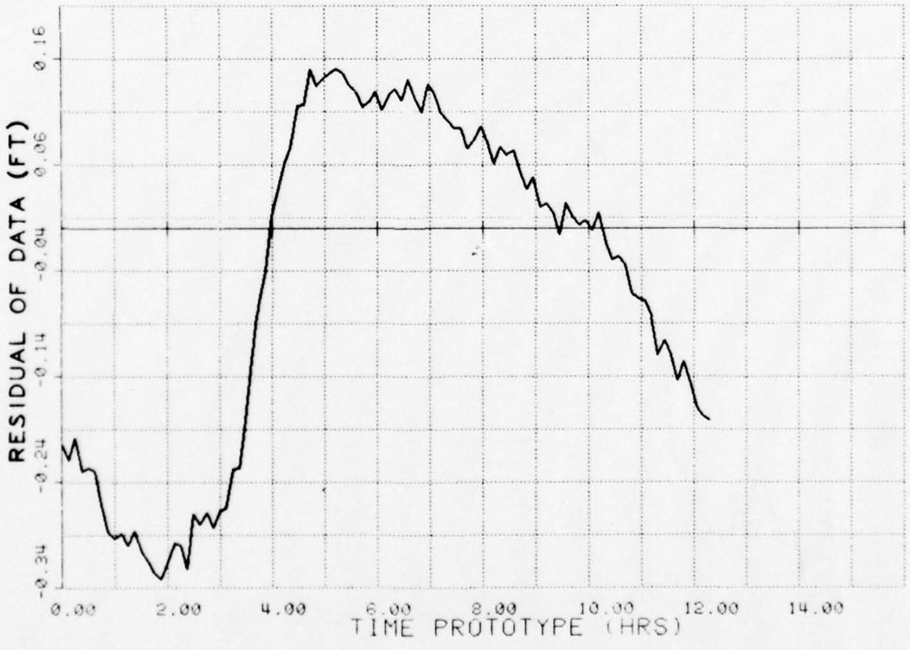
TIDAL ELEVATIONS
COMPARISON OF
PLAN 2 TO BASE
GAGE 8



NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 4 TO BASE
GAGE 1

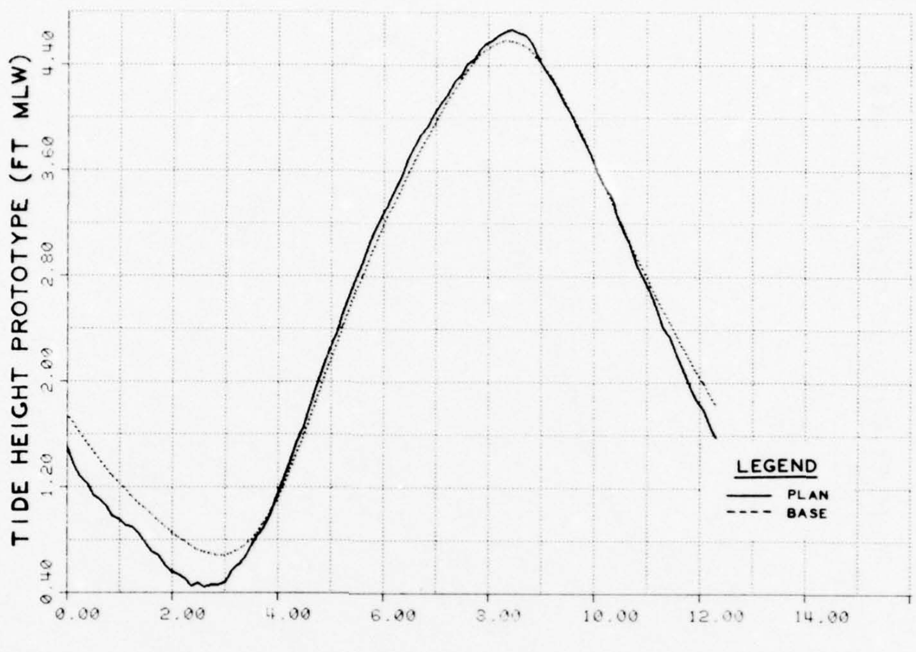




NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

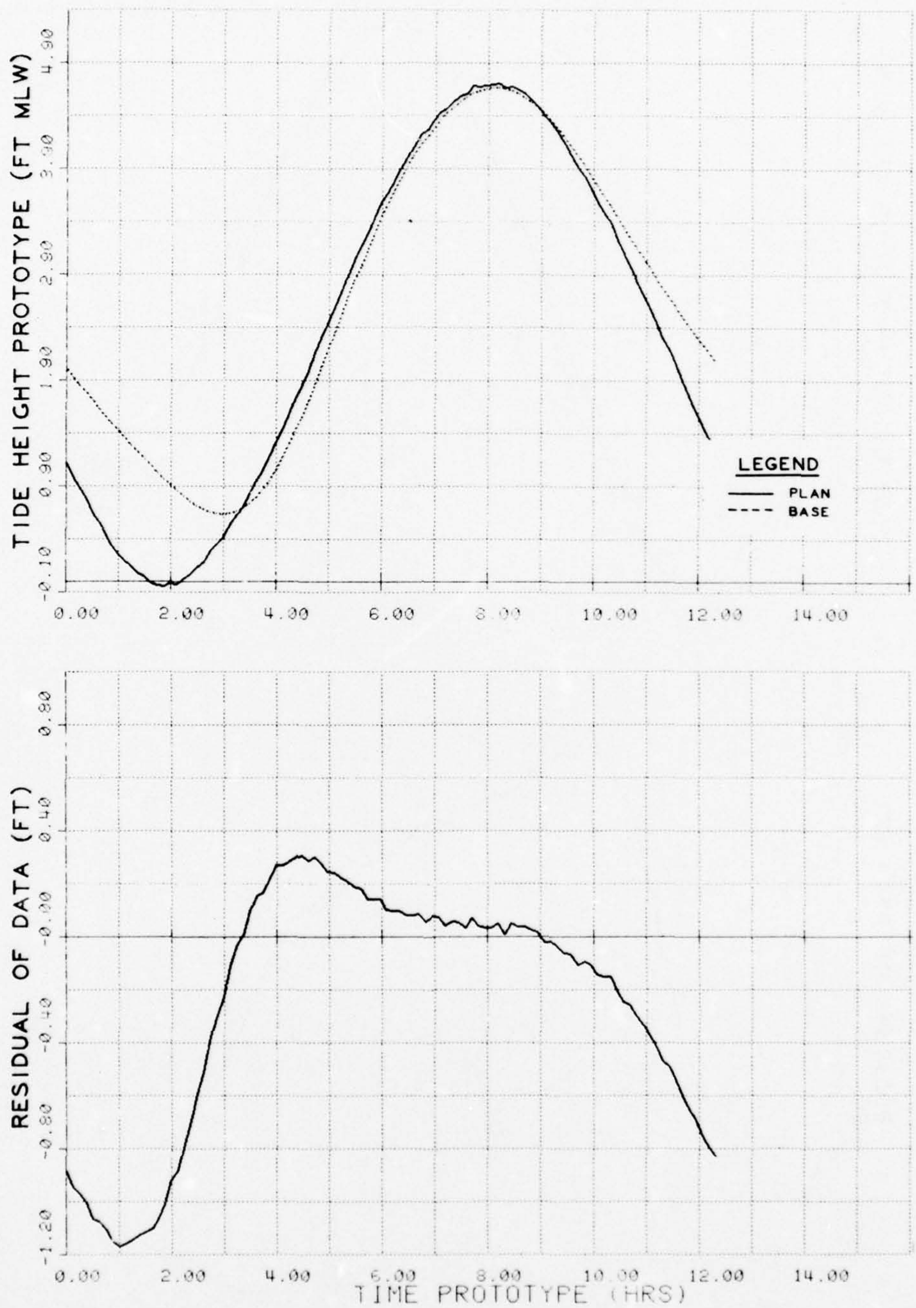
TIDAL ELEVATIONS
COMPARISON OF
PLAN 4 TO BASE

GAGE 2



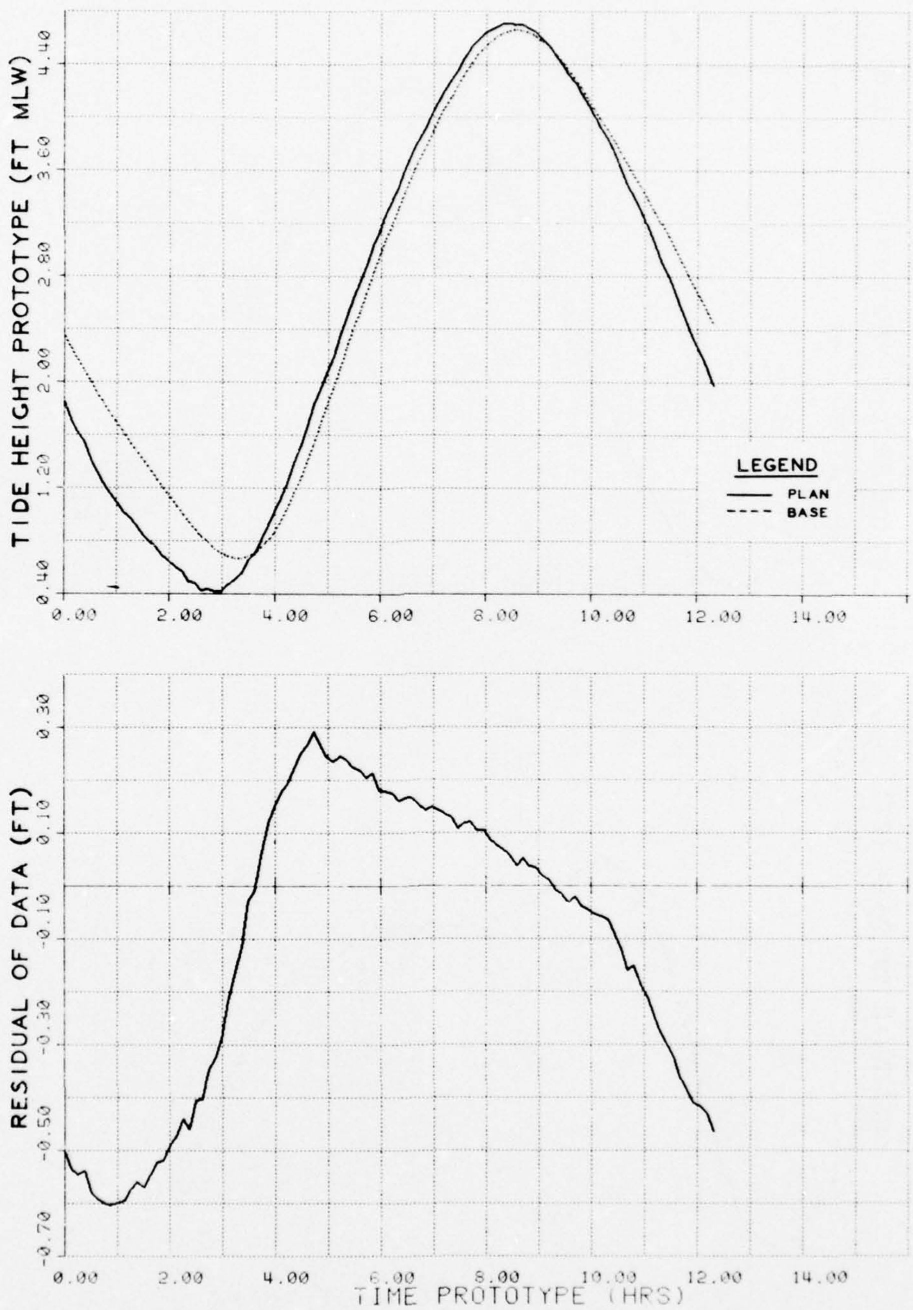
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 4 TO BASE
GAGE 3



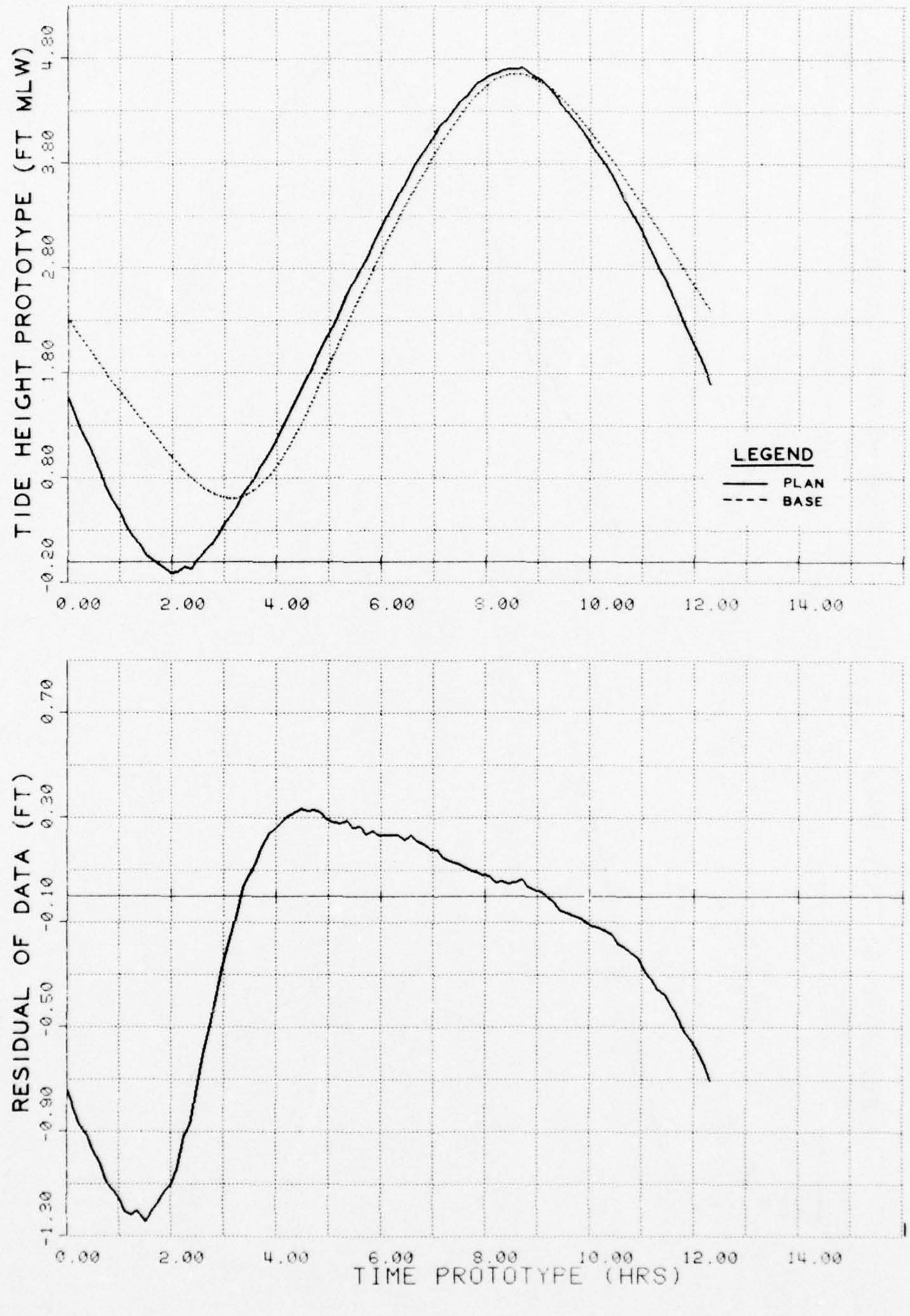
NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 4 TO BASE
GAGE 4



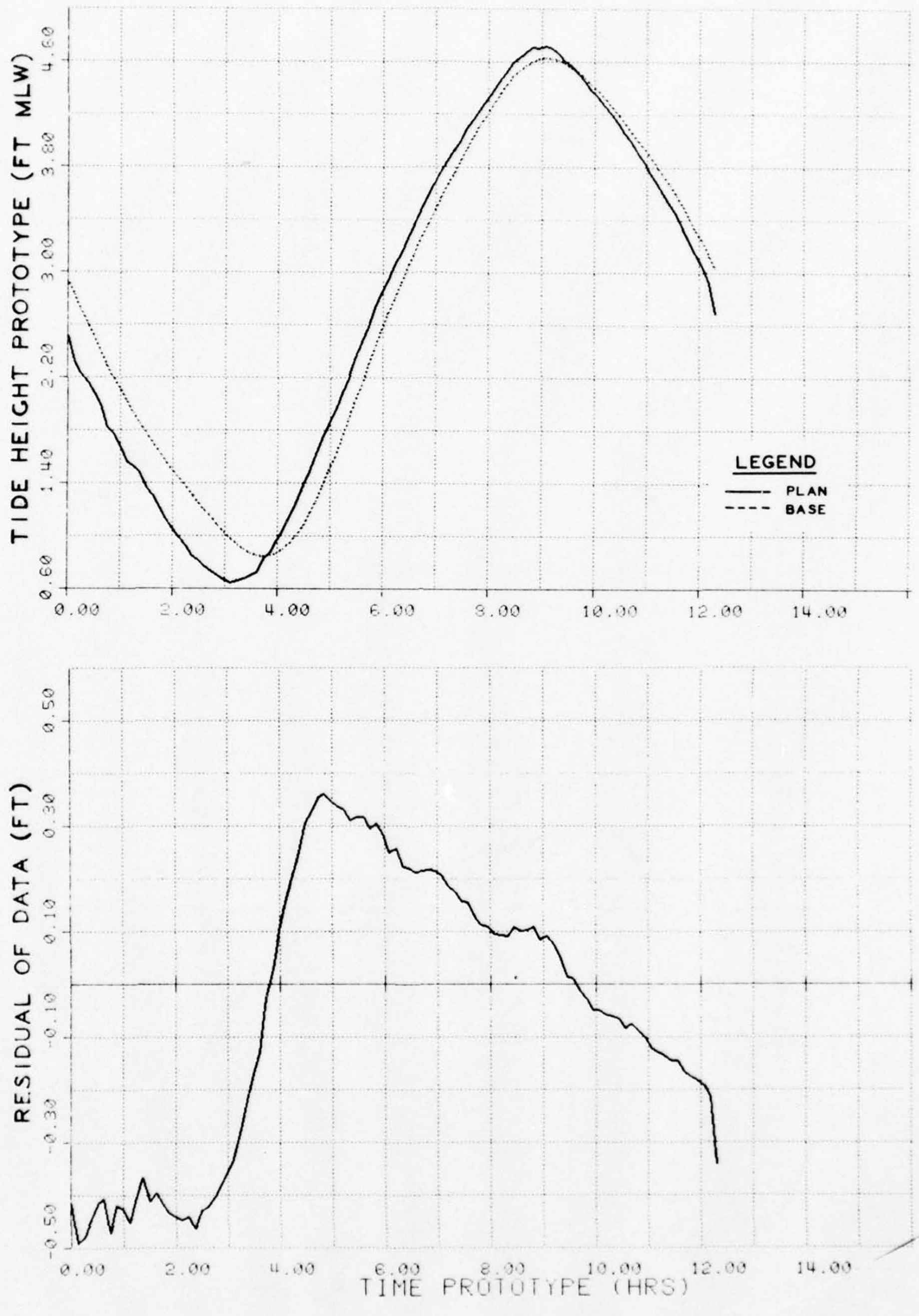
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 4 TO BASE
GAGE 5



NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

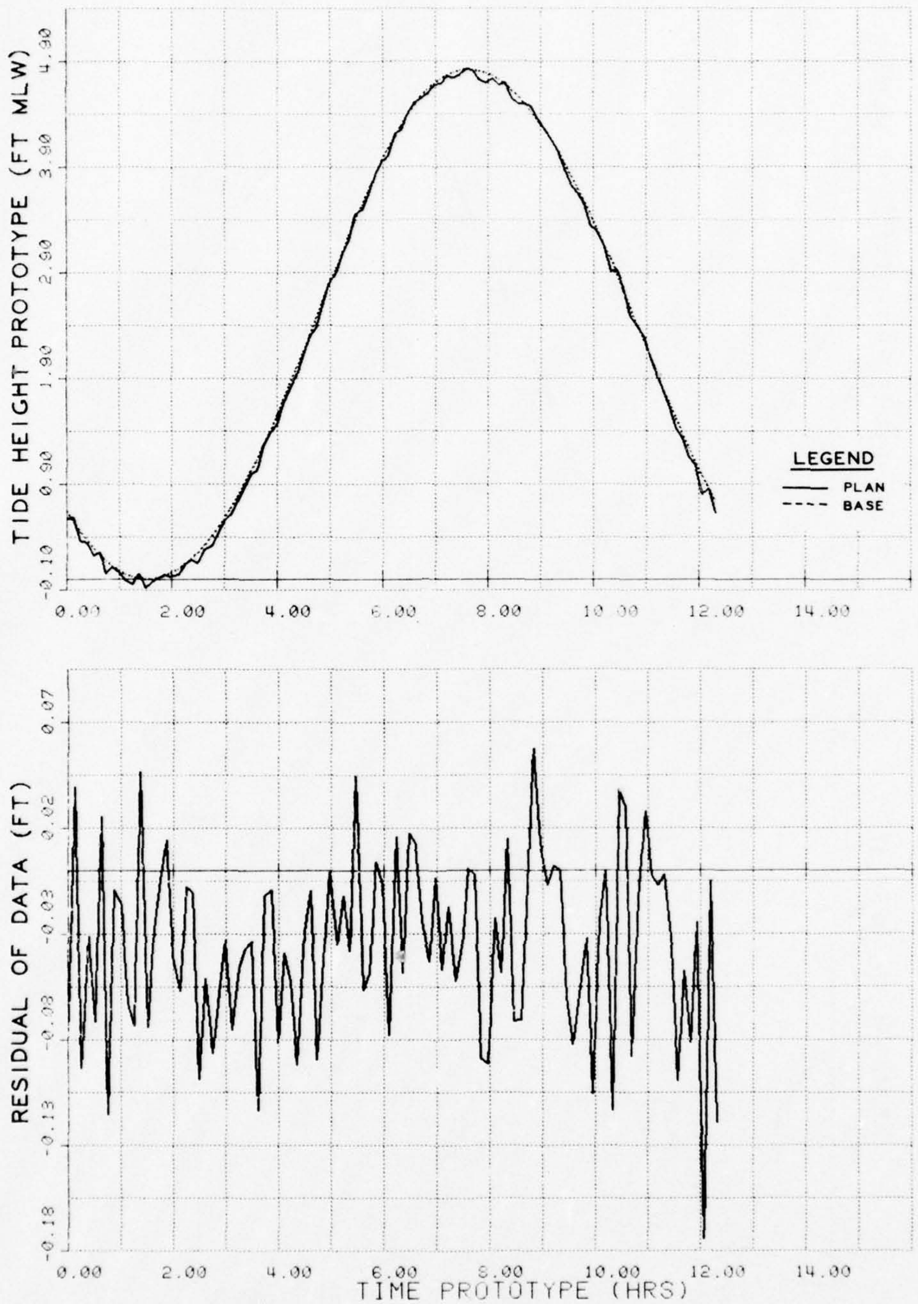
TIDAL ELEVATIONS
COMPARISON OF
PLAN 4 TO BASE
GAGE 6



NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 4 TO BASE

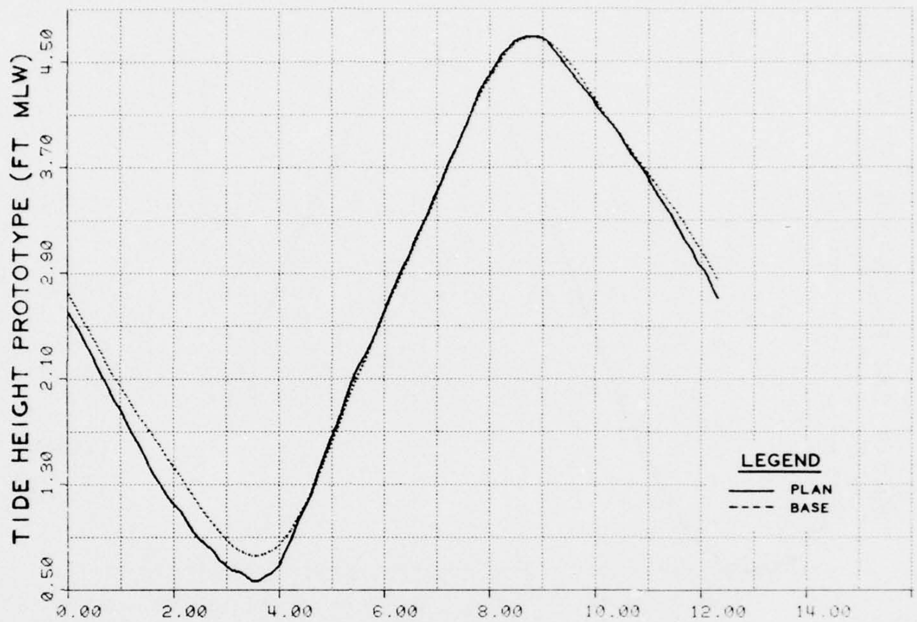
GAGE 7

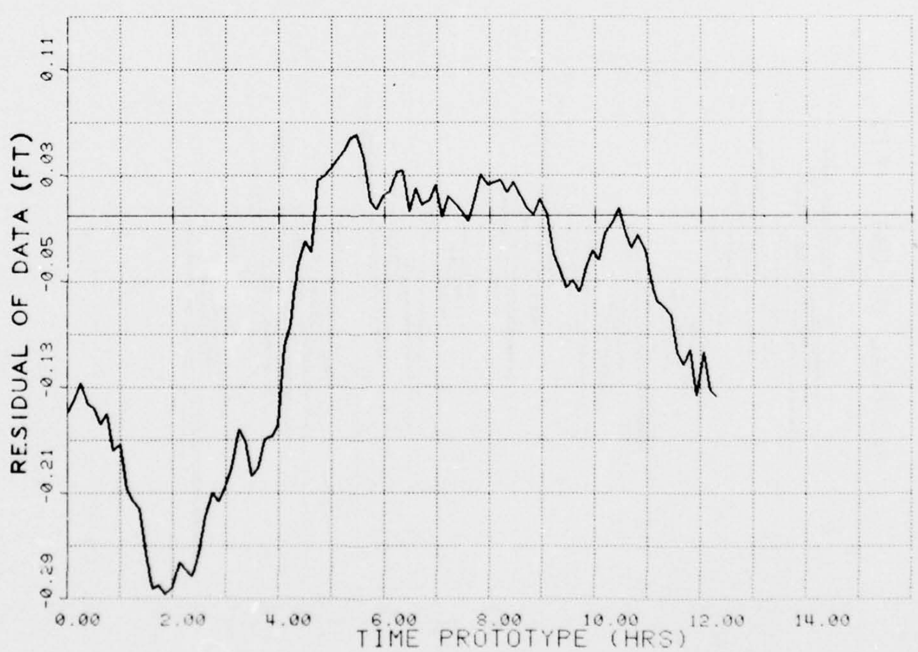


NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF PLAN 4 TO BASE

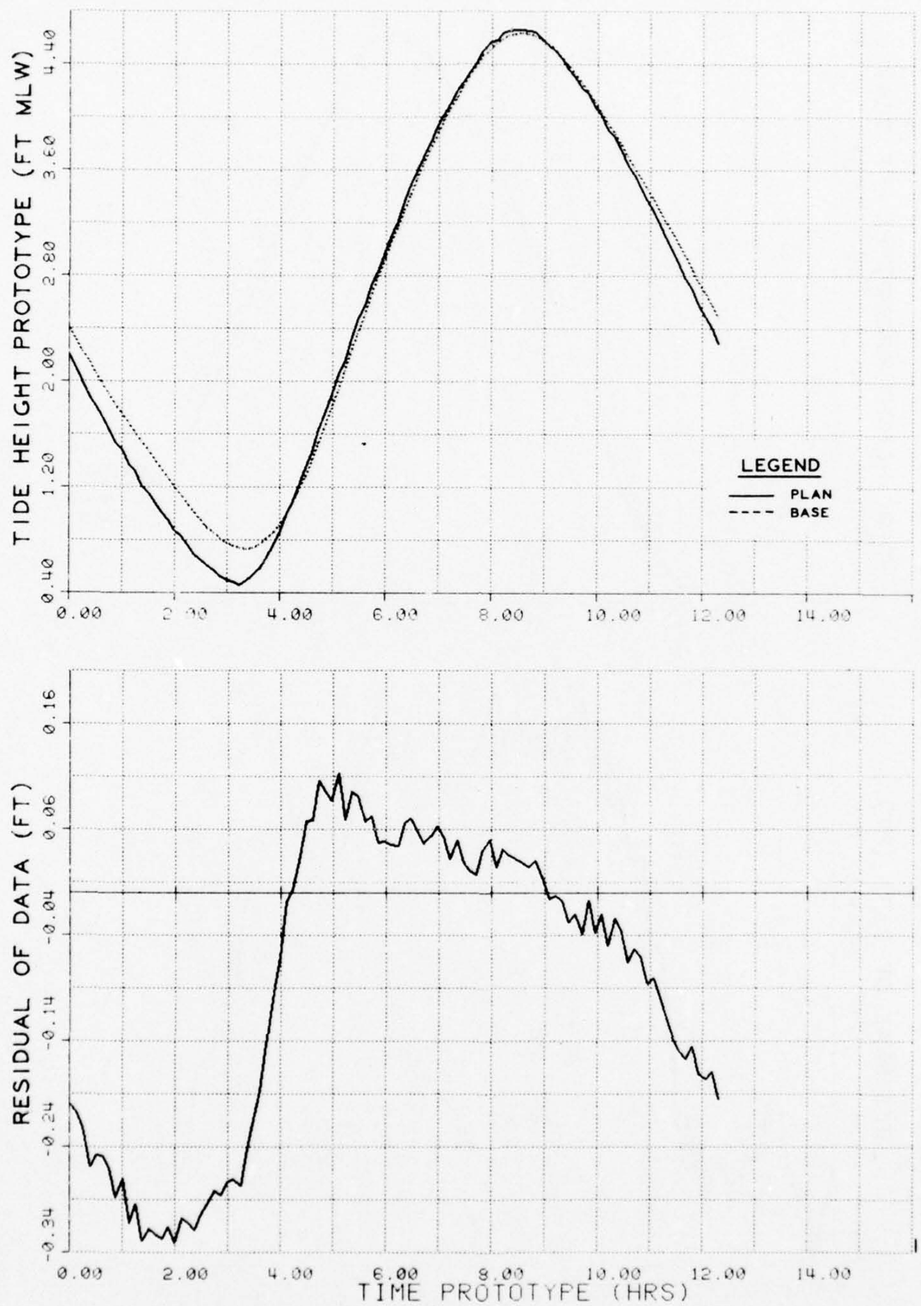
GAGE 8





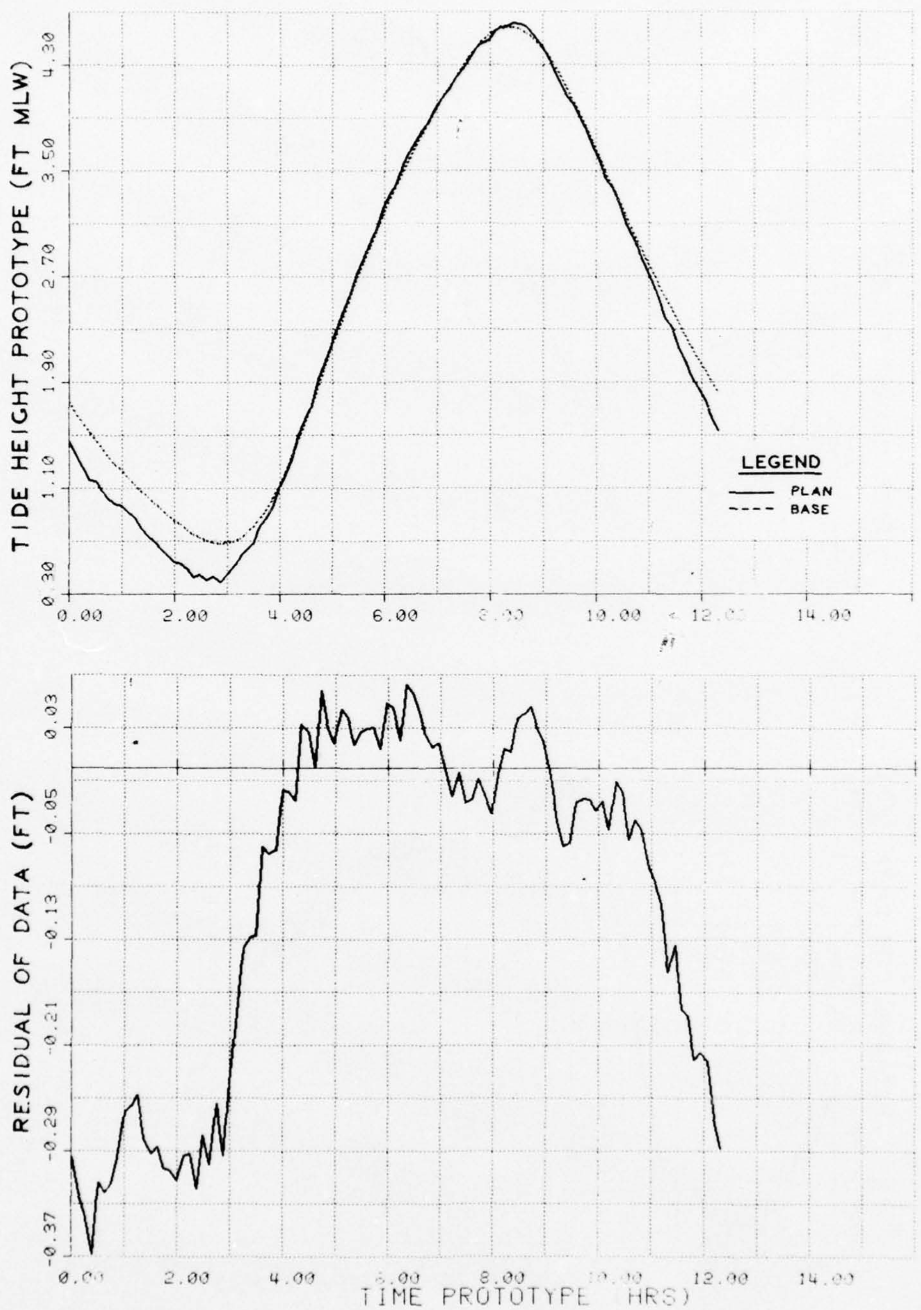
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 6 TO BASE
GAGE 1



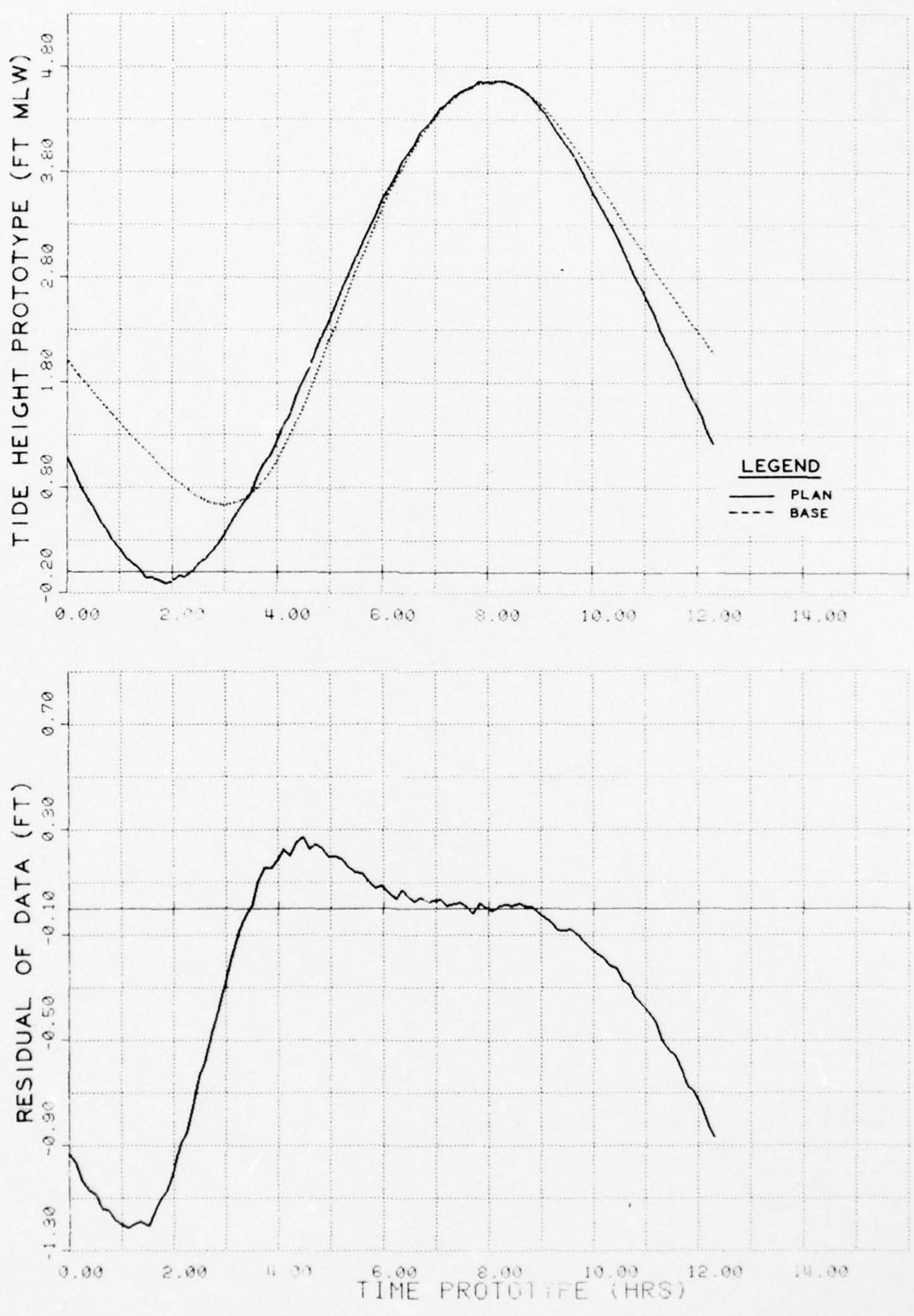
NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF PLAN 6 TO BASE
GAGE 2



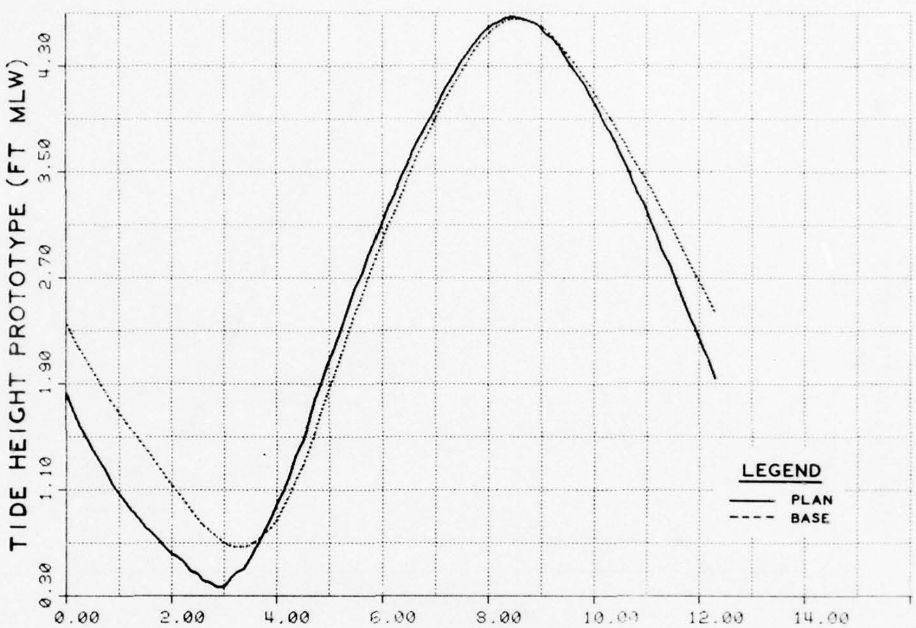
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

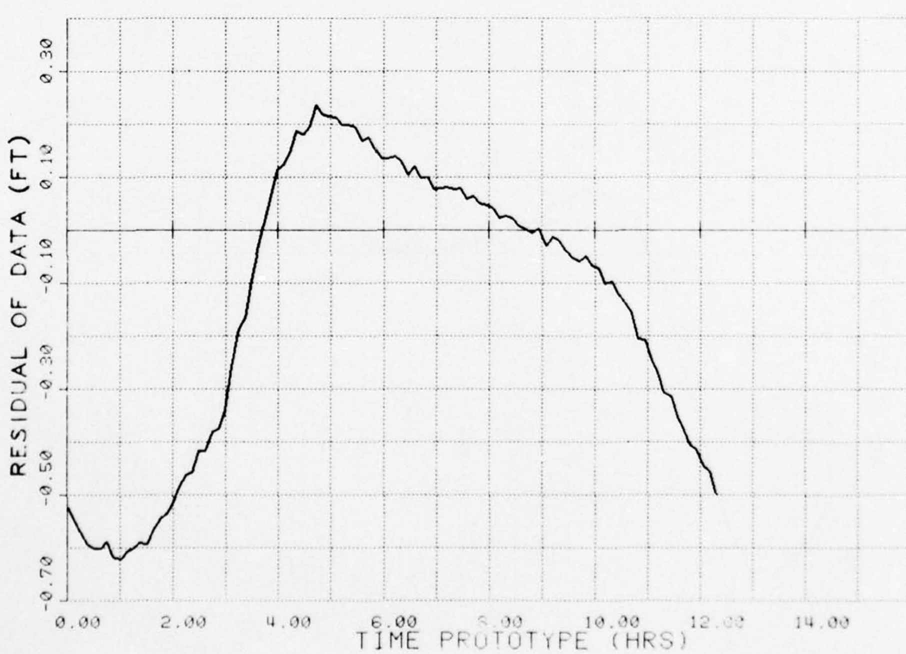
TIDAL ELEVATIONS
COMPARISON OF
PLAN 6 TO BASE
GAGE 3



NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

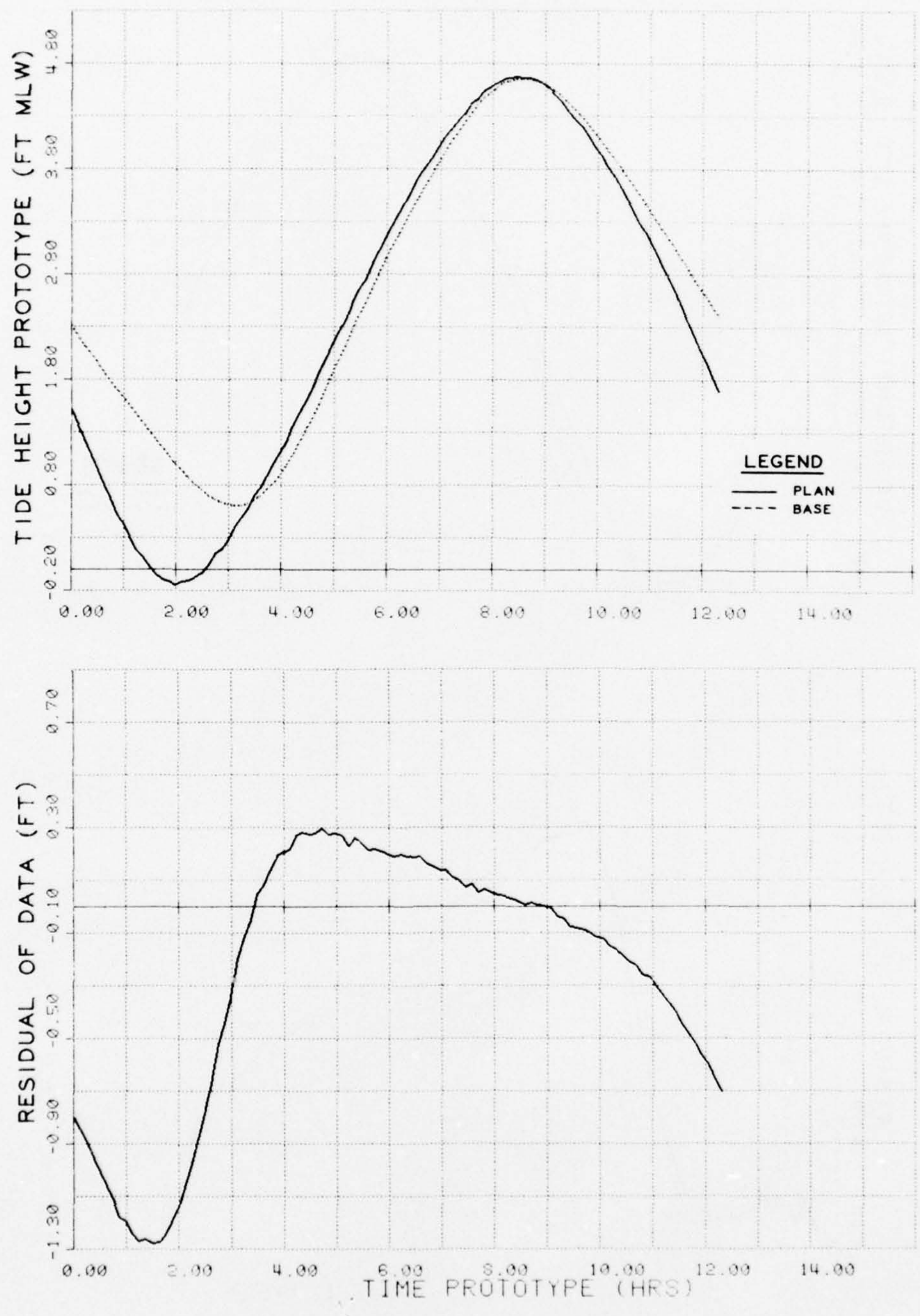
TIDAL ELEVATIONS
COMPARISON OF
PLAN 6 TO BASE
GAGE 4





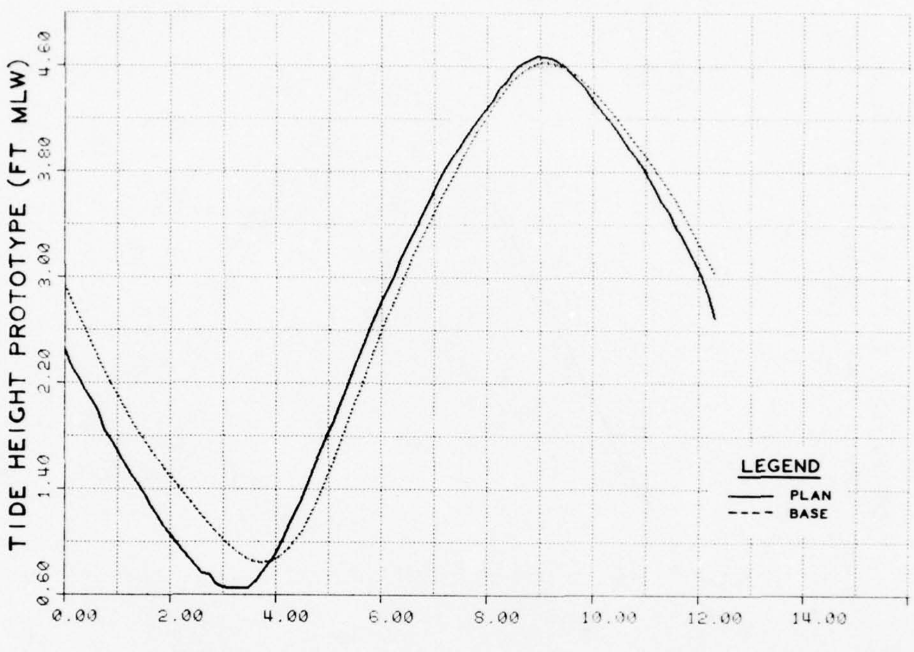
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 6 TO BASE
GAGE 5



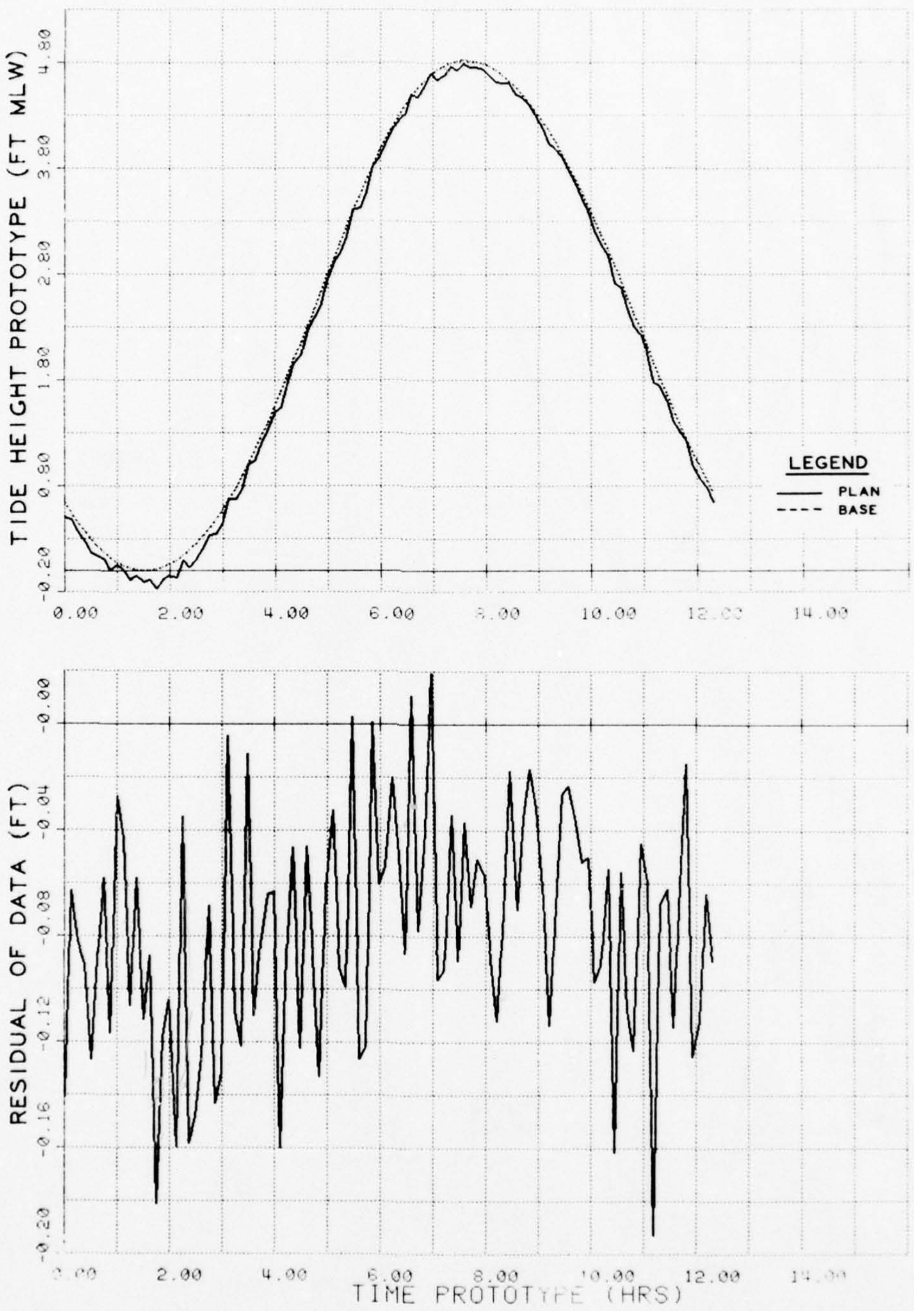
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 6 TO BASE
GAGE 6



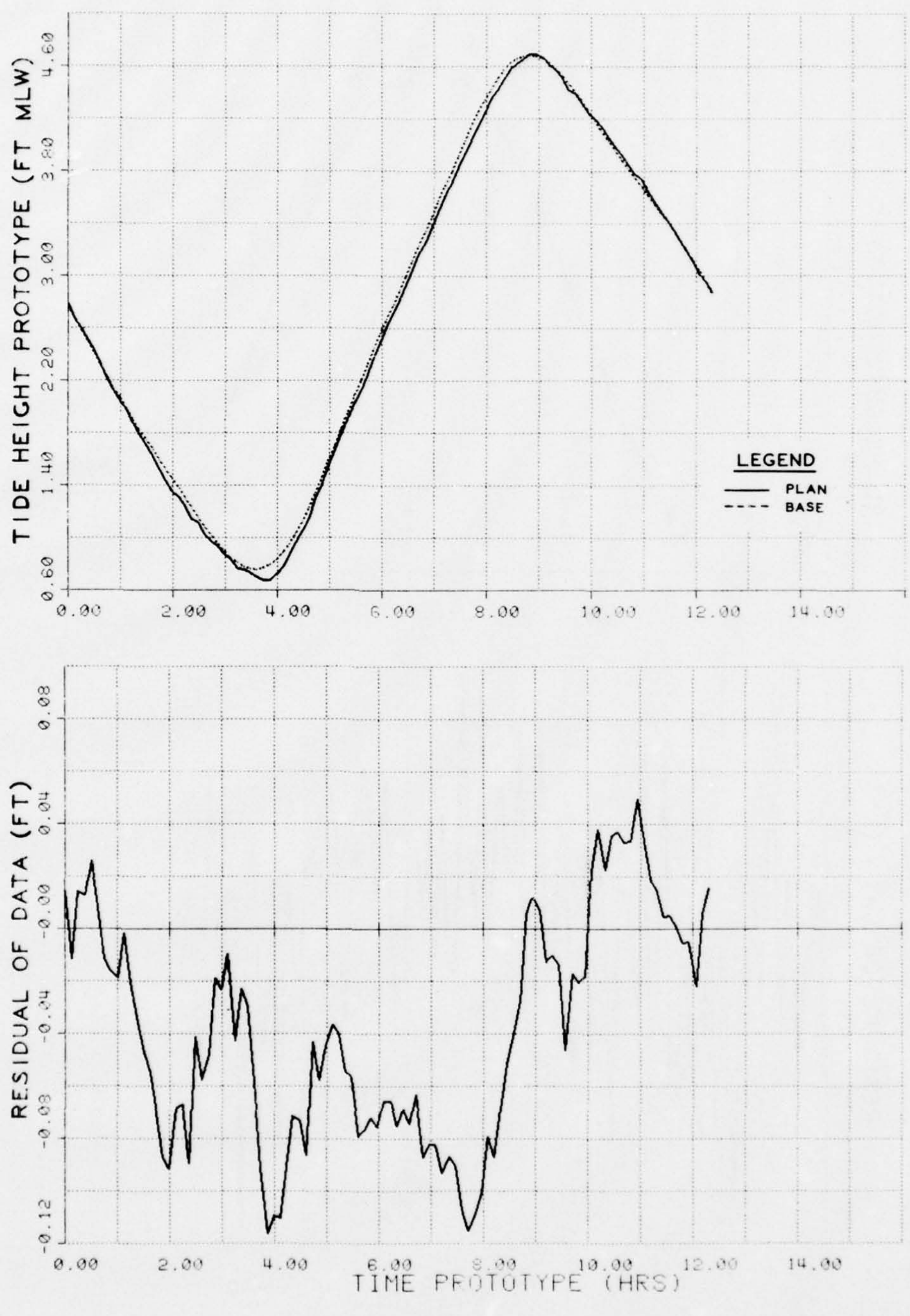
NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF PLAN 6 TO BASE
GAGE 7



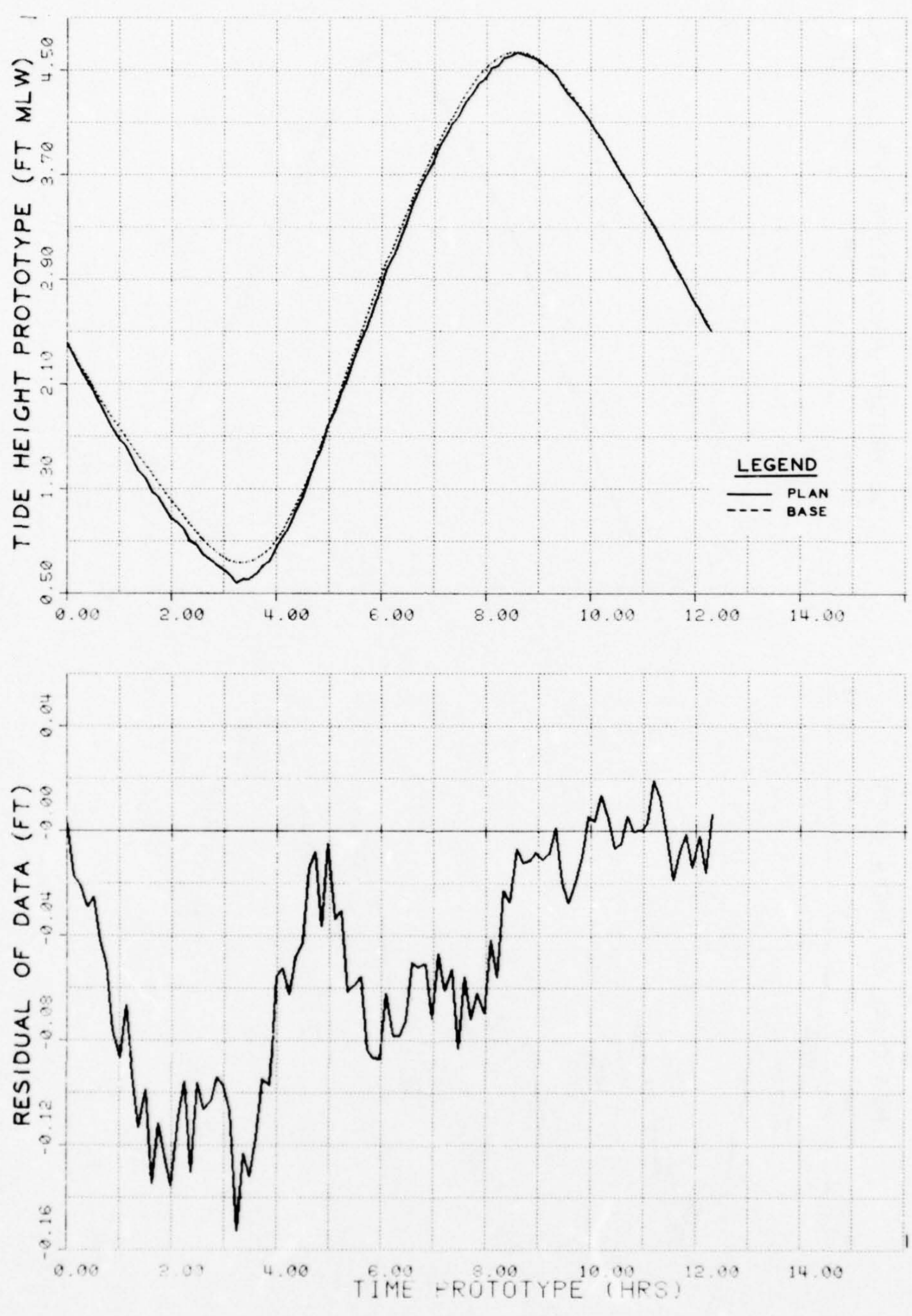
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 6 TO BASE
GAGE 8



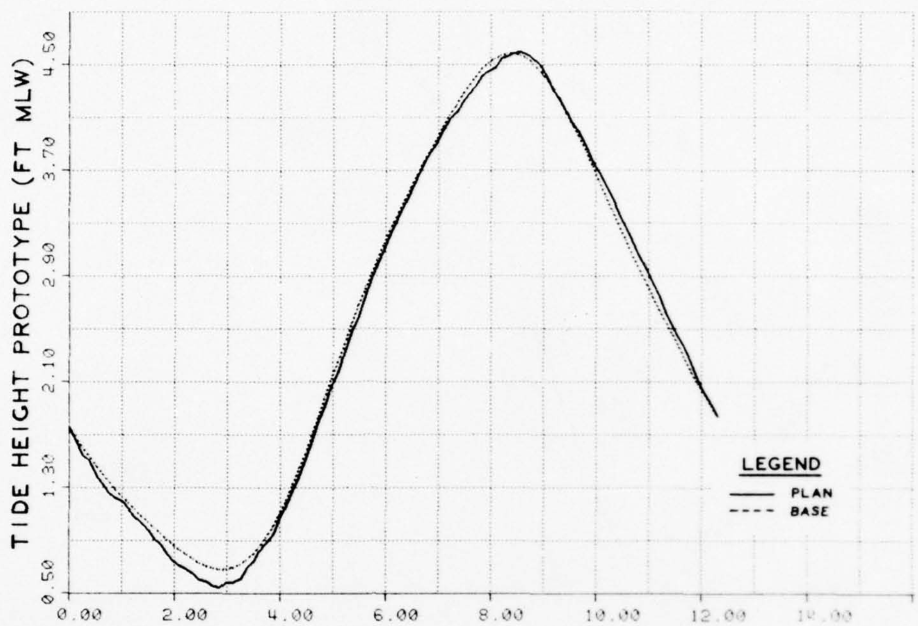
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

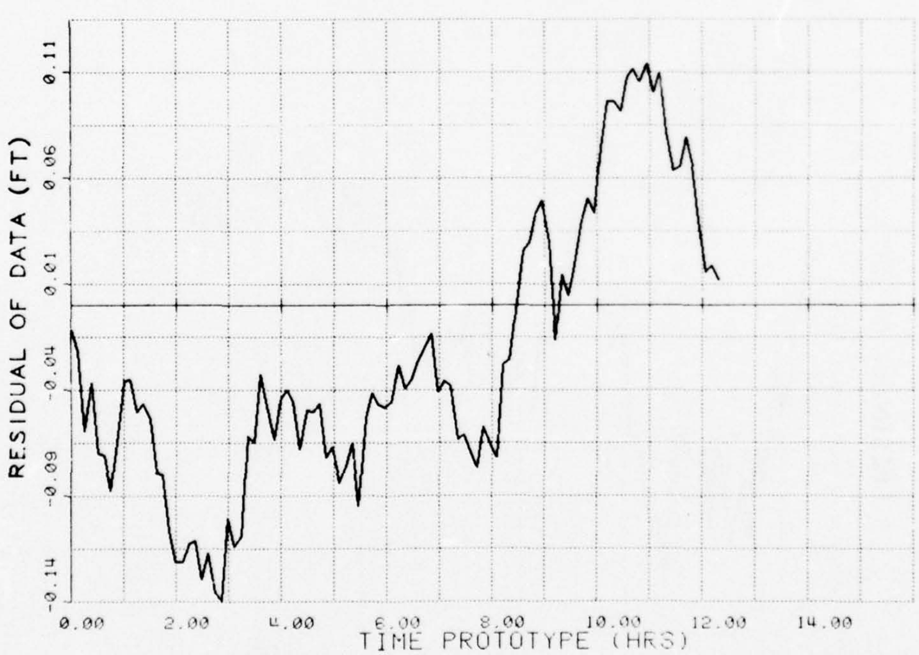
TIDAL ELEVATIONS
COMPARISON OF
PLAN 7 TO BASE
GAGE 1



NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

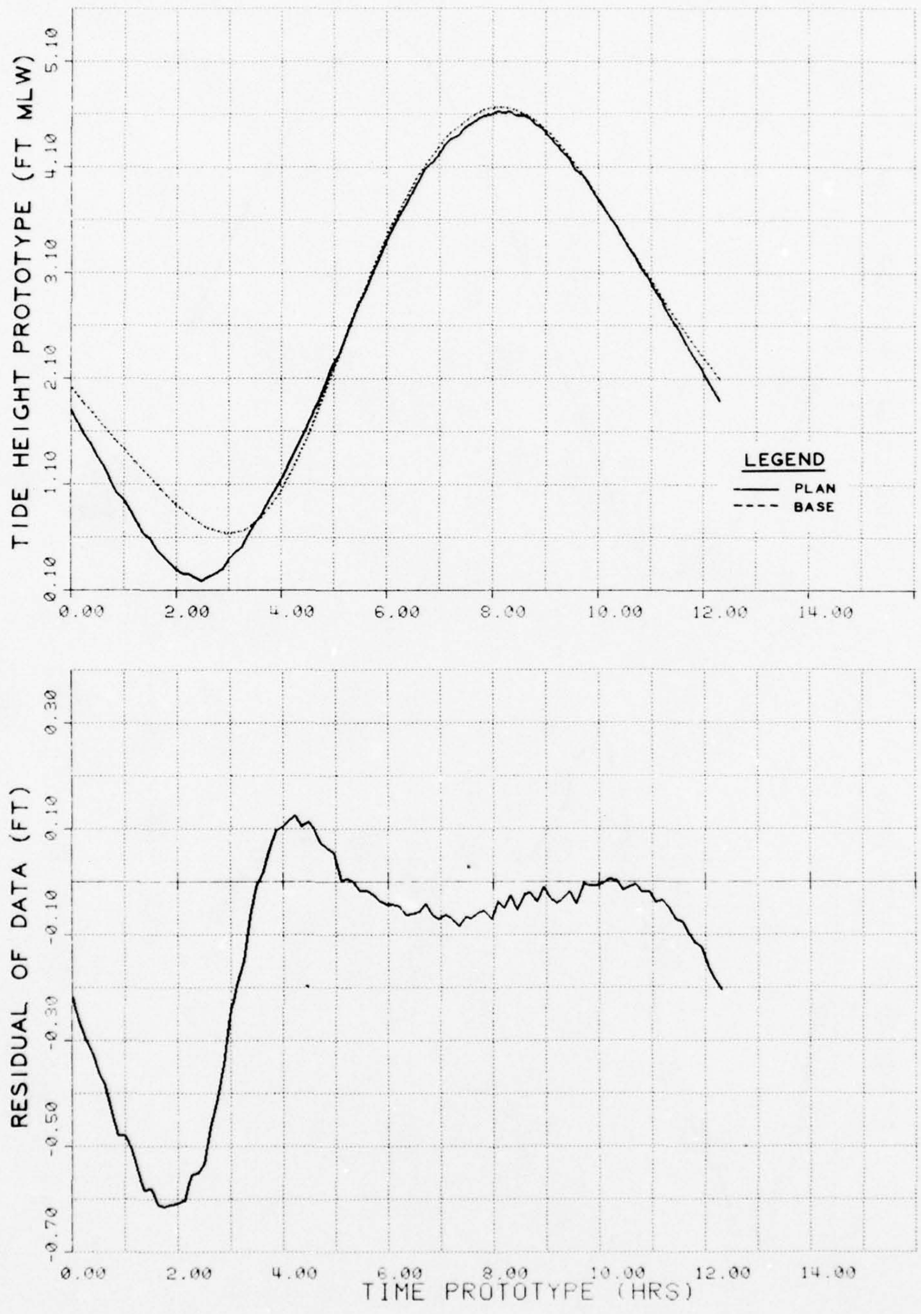
TIDAL ELEVATIONS
COMPARISON OF
PLAN 7 TO BASE
GAGE 2





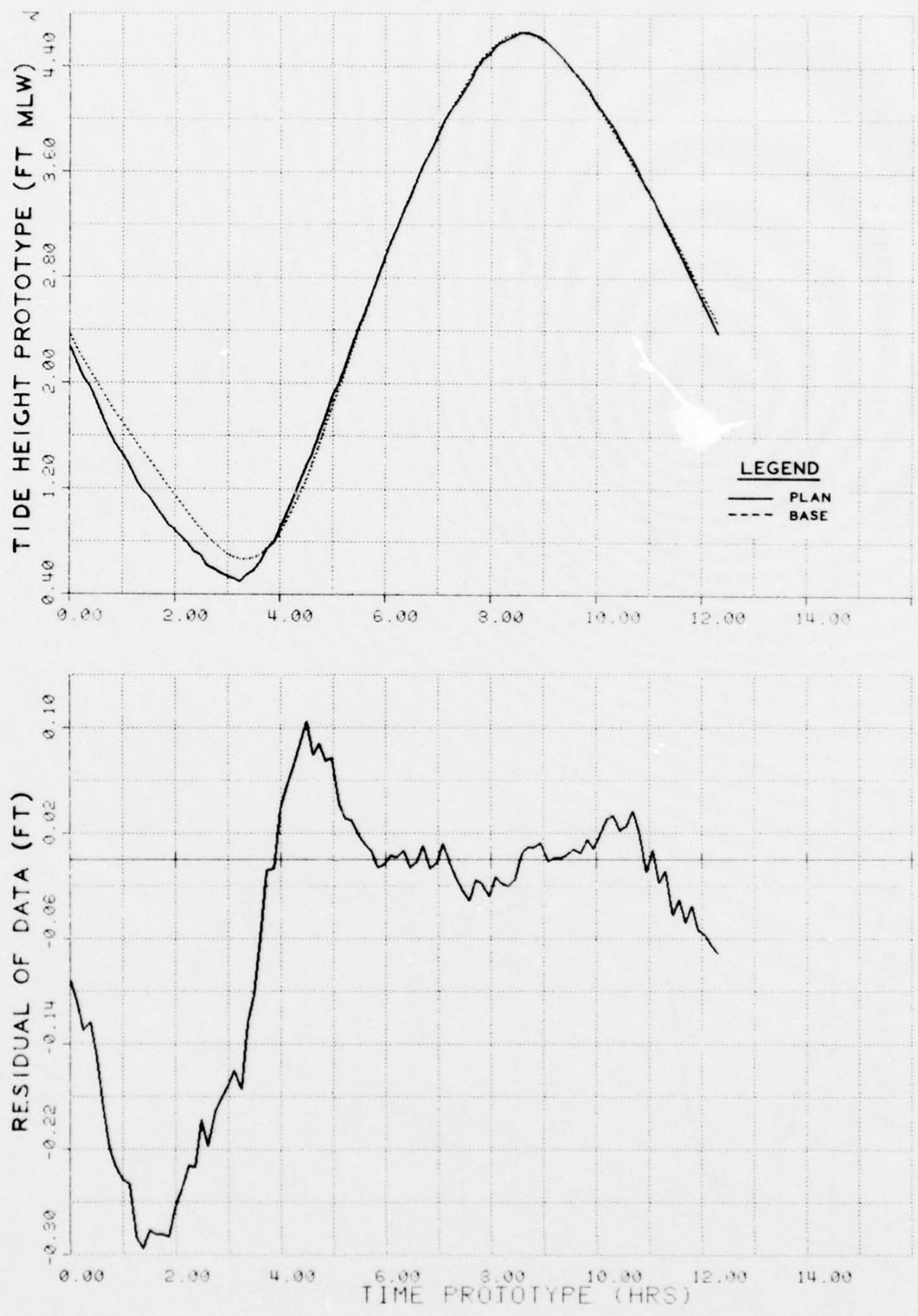
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 7 TO BASE
GAGE 3



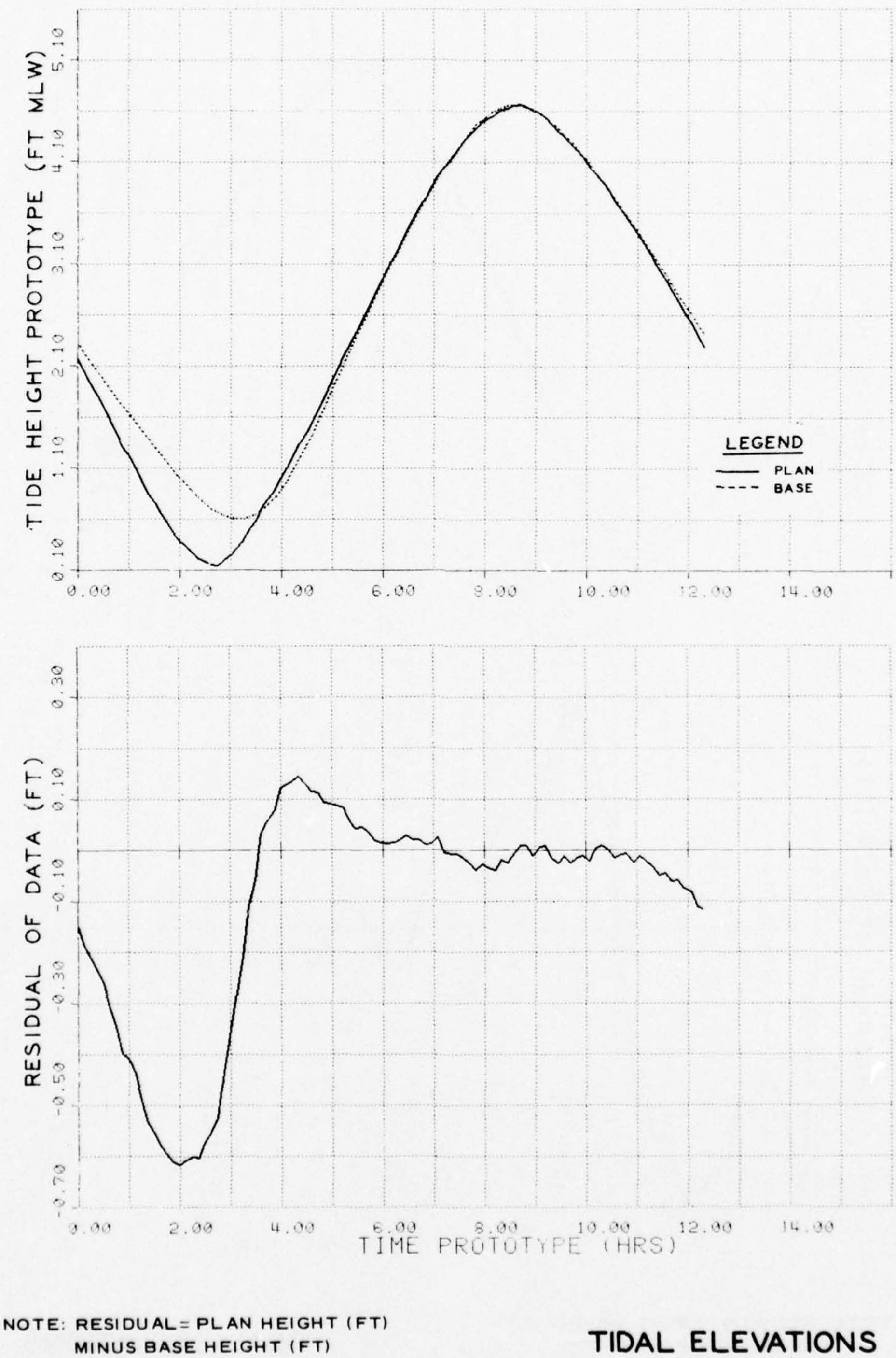
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 7 TO BASE
GAGE 4



NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

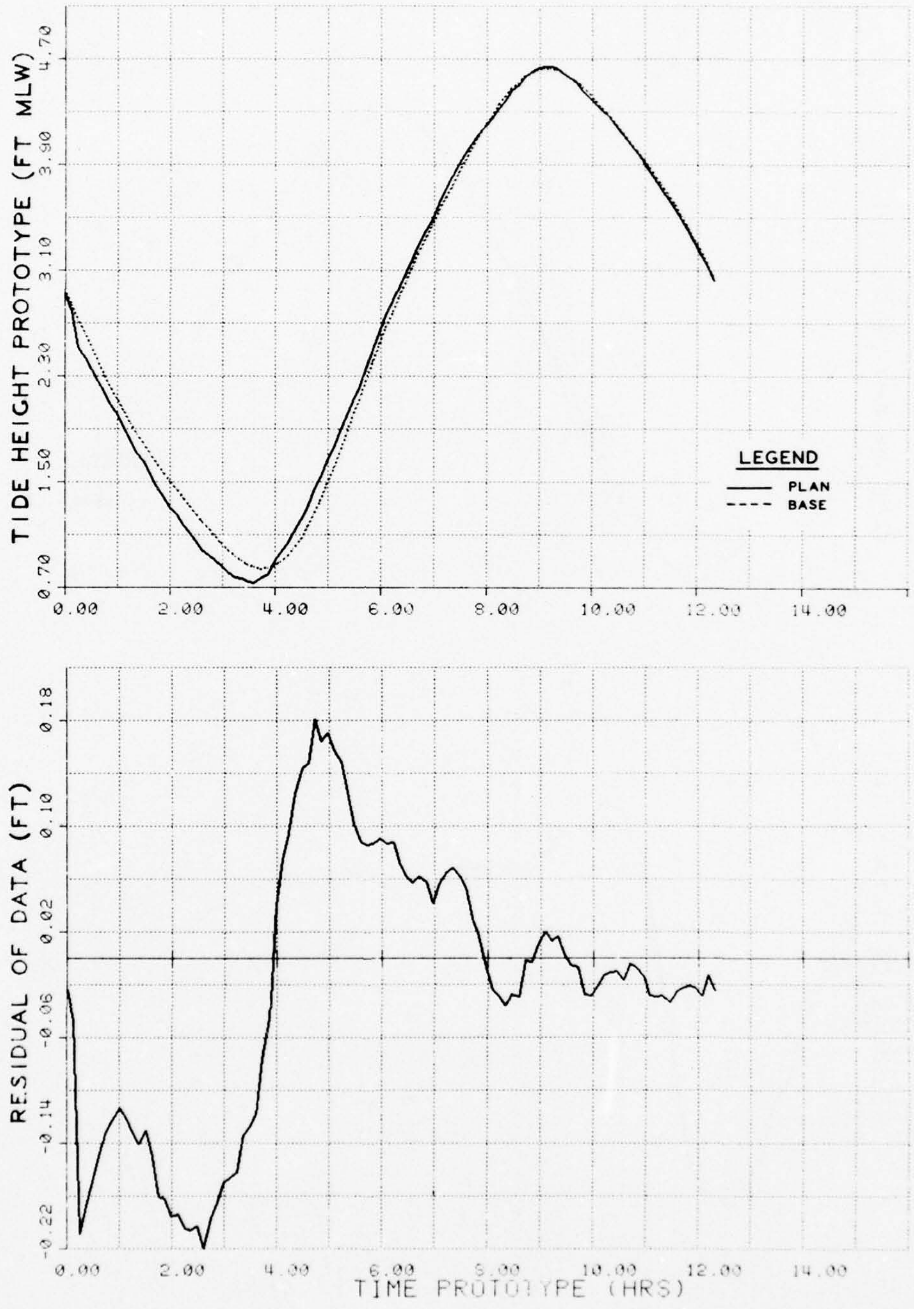
TIDAL ELEVATIONS
COMPARISON OF PLAN 7 TO BASE
GAGE 5



NOTE: RESIDUAL = PLAN HEIGHT (FT) MINUS BASE HEIGHT (FT)

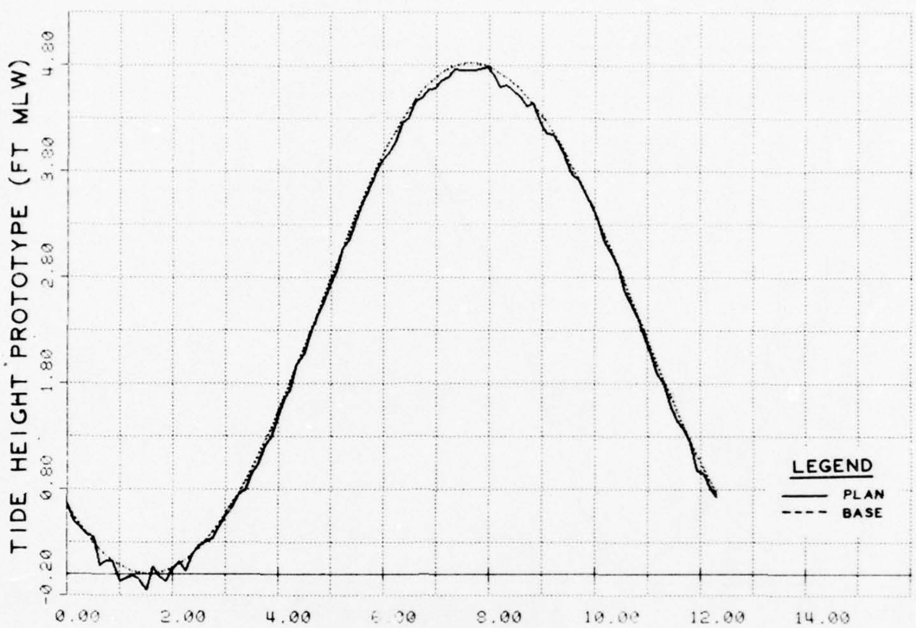
TIDAL ELEVATIONS
COMPARISON OF
PLAN 7 TO BASE

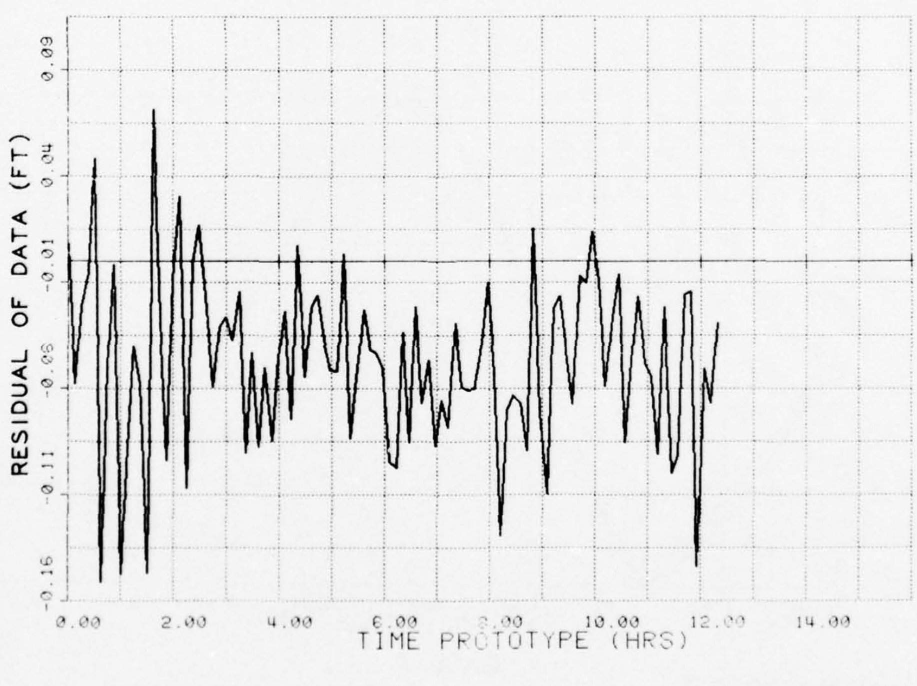
GAGE 6



NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF PLAN 7 TO BASE
GAGE 7

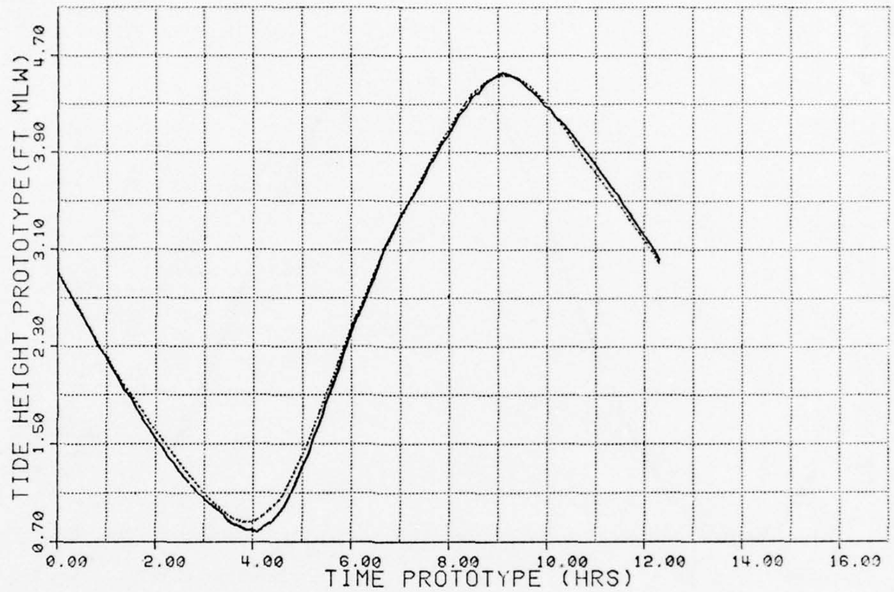




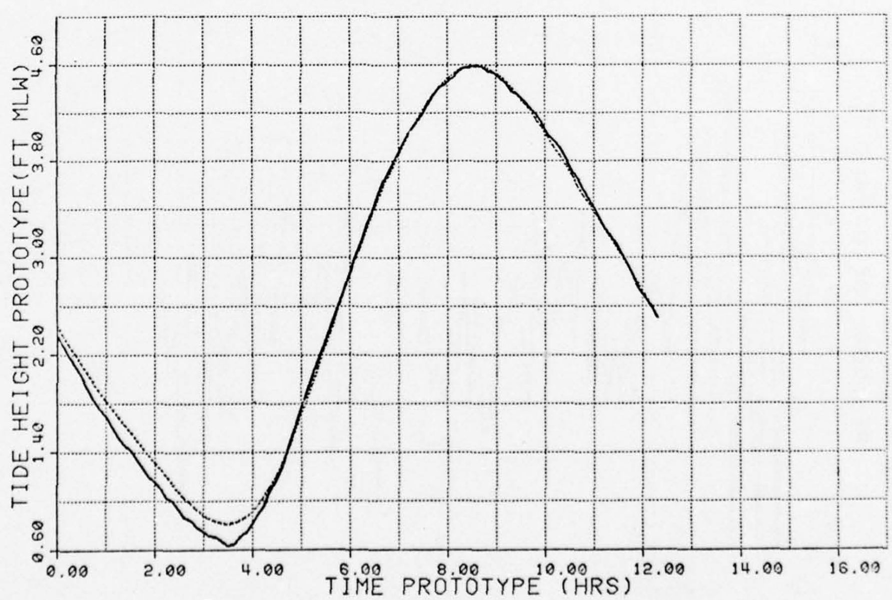
NOTE: RESIDUAL = PLAN HEIGHT (FT)
MINUS BASE HEIGHT (FT)

TIDAL ELEVATIONS
COMPARISON OF
PLAN 7 TO BASE

GAGE 8



GAGE 1



GAGE 2

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

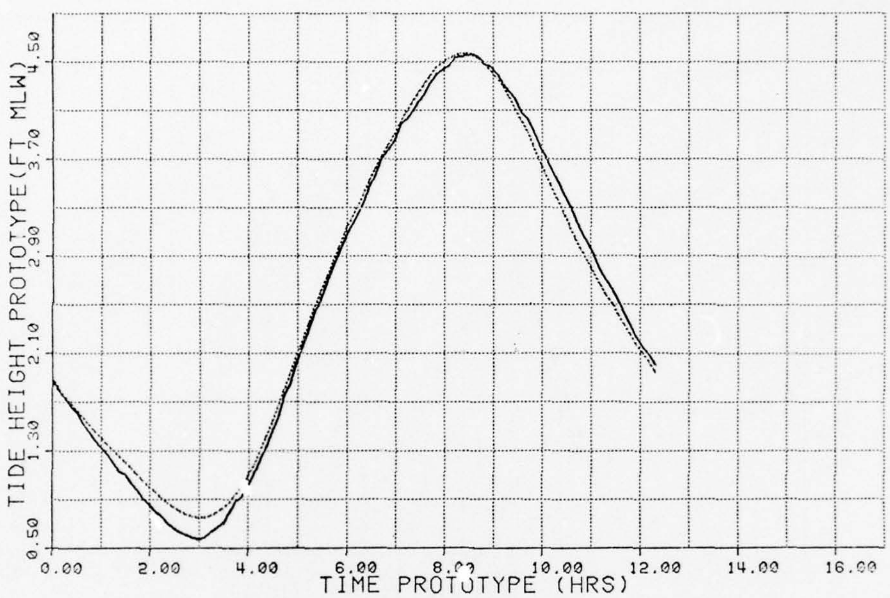
LEGEND

.... BASE

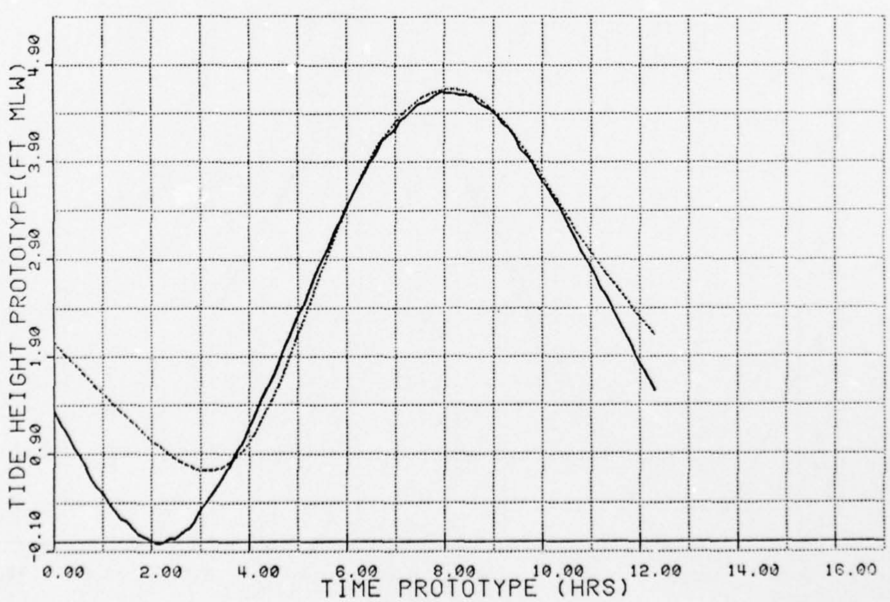
———— PLAN 1C

EFFECTS OF PLAN 1B ON TIDAL ELEVATIONS

GAGES 1 AND 2



GAGE 3



GAGE 4

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

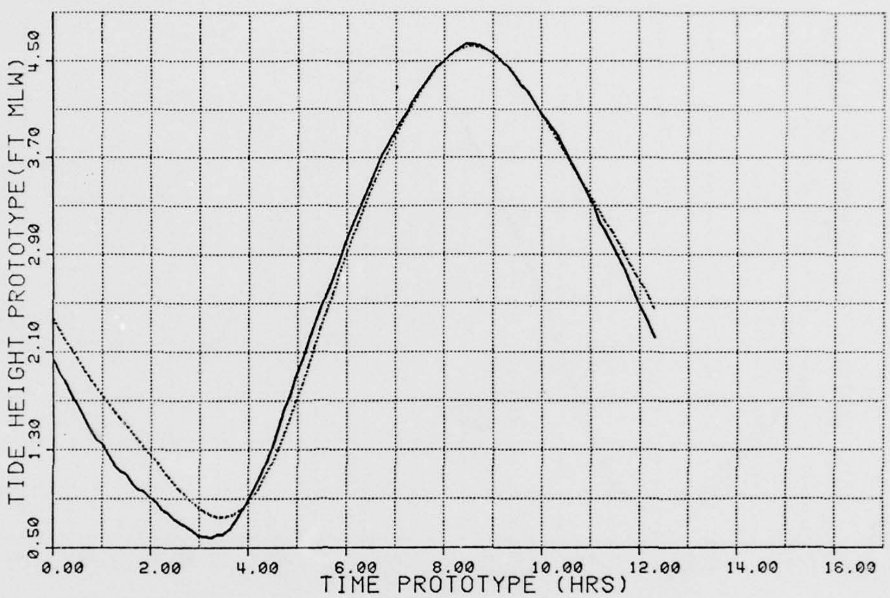
LEGEND

.... BASE

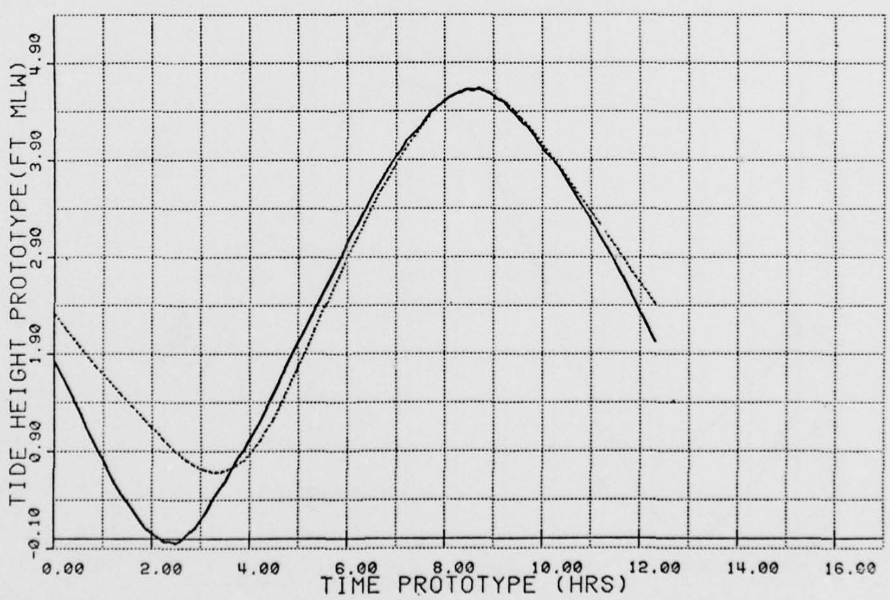
——— PLAN 1C

EFFECTS OF PLAN 1B
ON TIDAL ELEVATIONS

GAGES 3 AND 4



GAGE 5



GAGE 6

TEST CONDITIONS

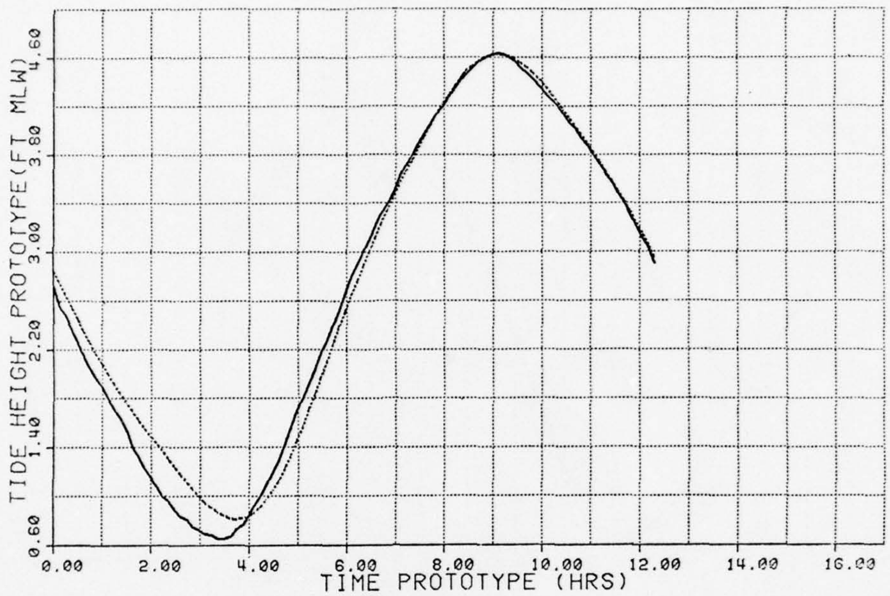
OCEAN TIDE RANGE 4.8 FT

LEGEND

BASE

PLAN 1C

EFFECTS OF PLAN 1B
ON TIDAL ELEVATIONS
GAGES 5 AND 6



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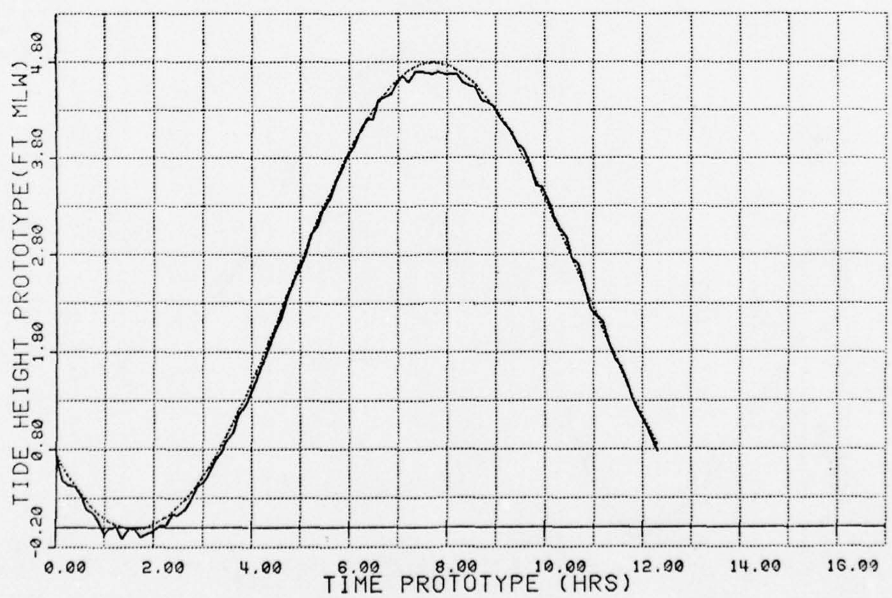


GAGE 8

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

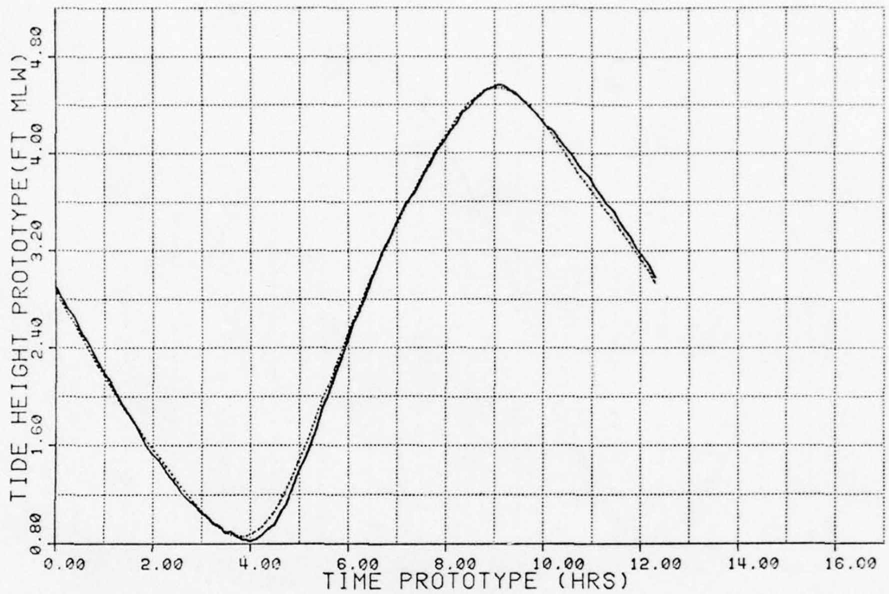
LEGEND

.... BASE

———— PLAN 1C

EFFECTS OF PLAN 1B ON TIDAL ELEVATIONS

GAGES 7 AND 8



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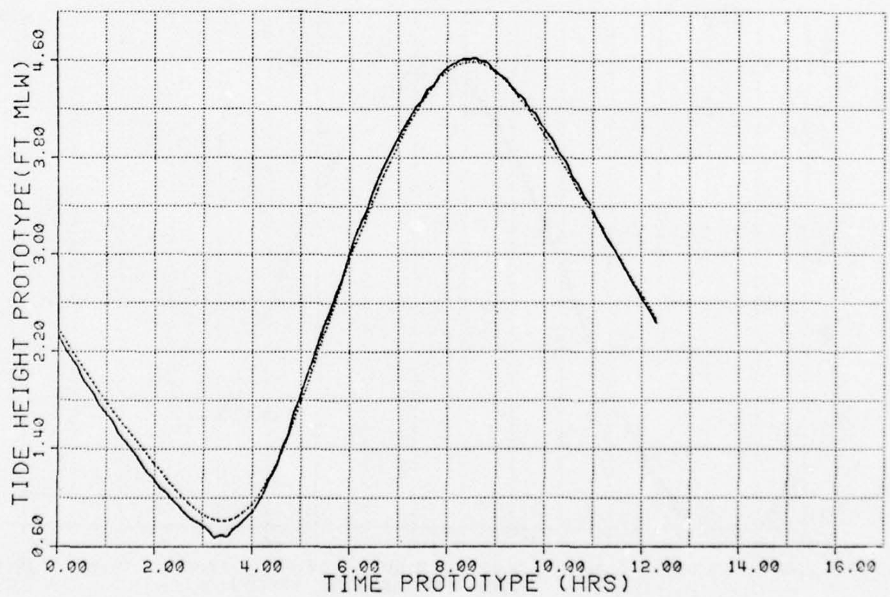


GAGE 2

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

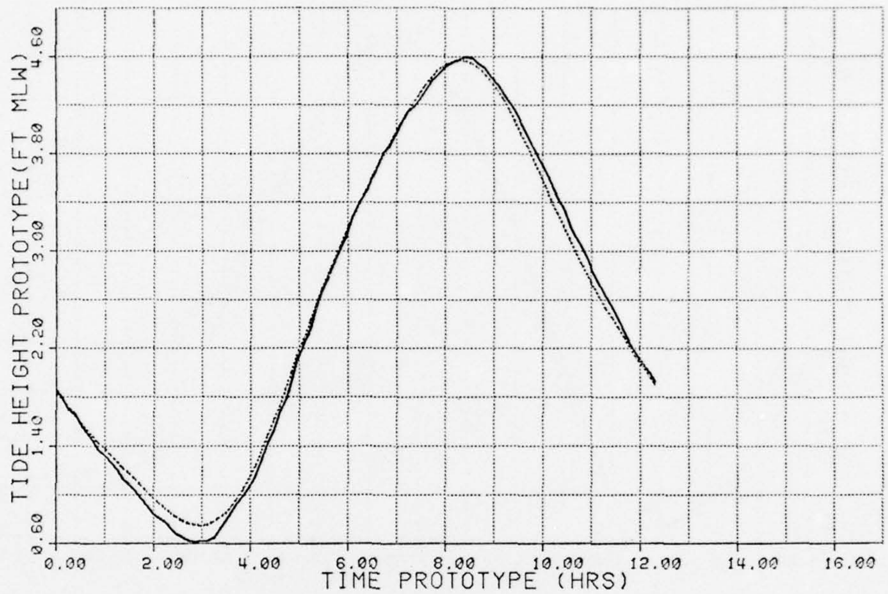
LEGEND

BASE

PLAN 1C

EFFECTS OF PLAN 1C ON TIDAL ELEVATIONS

GAGES 1 AND 2



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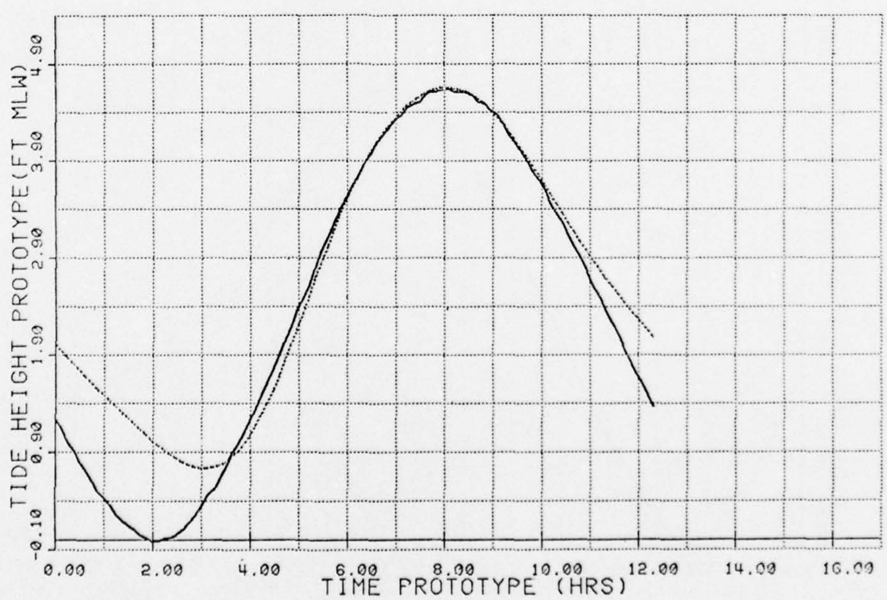


GAGE 4

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

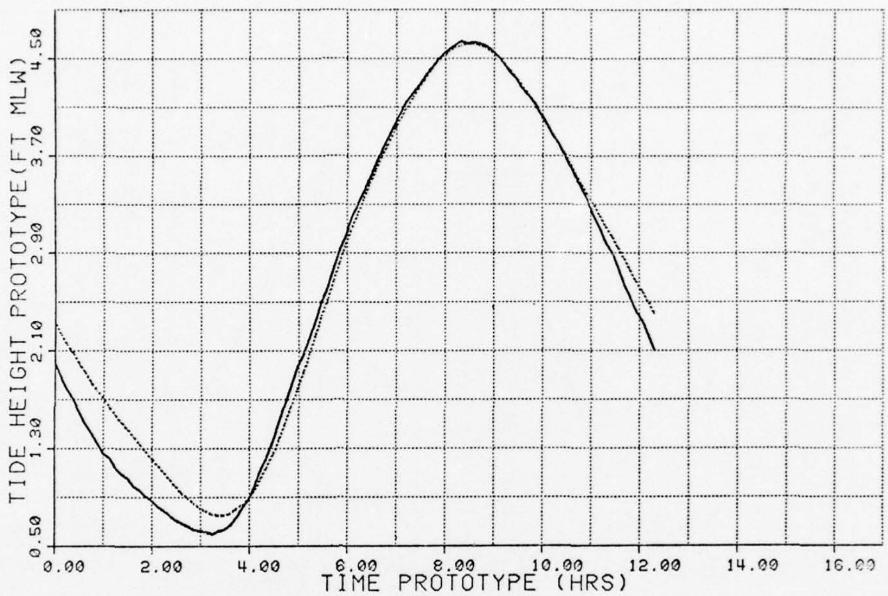
LEGEND

.... BASE

——— PLAN 1C

EFFECTS OF PLAN 1C ON TIDAL ELEVATIONS

GAGES 3 AND 4



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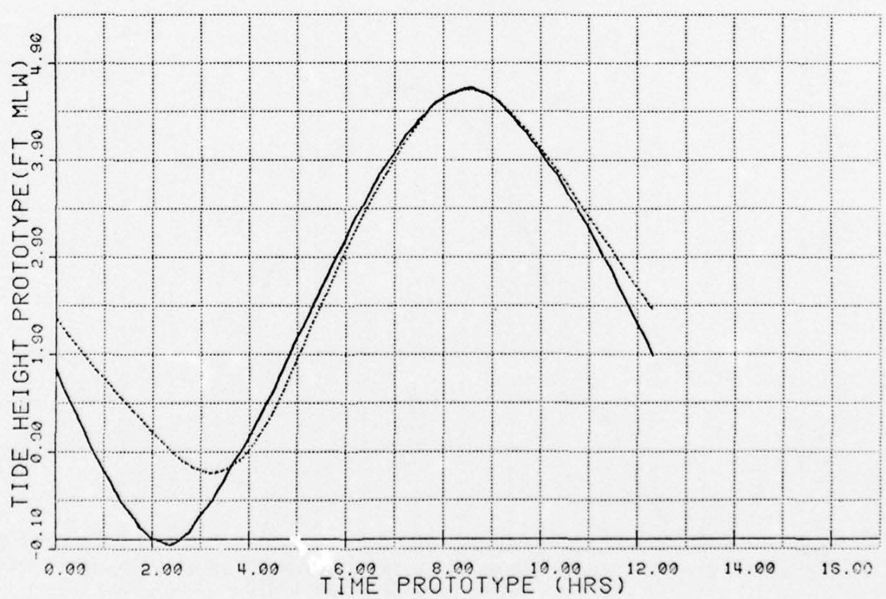


GAGE 6

TEST CONDITIONS

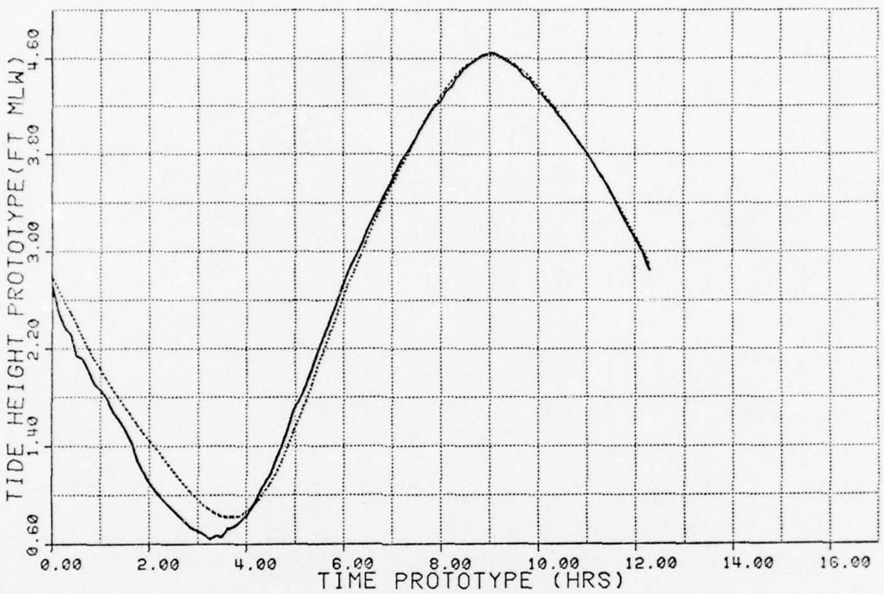
OCEAN TIDE RANGE 4.8 FT

LEGEND

.... BASE
———— PLAN 1C

EFFECTS OF PLAN 1C ON TIDAL ELEVATIONS

GAGES 5 AND 6



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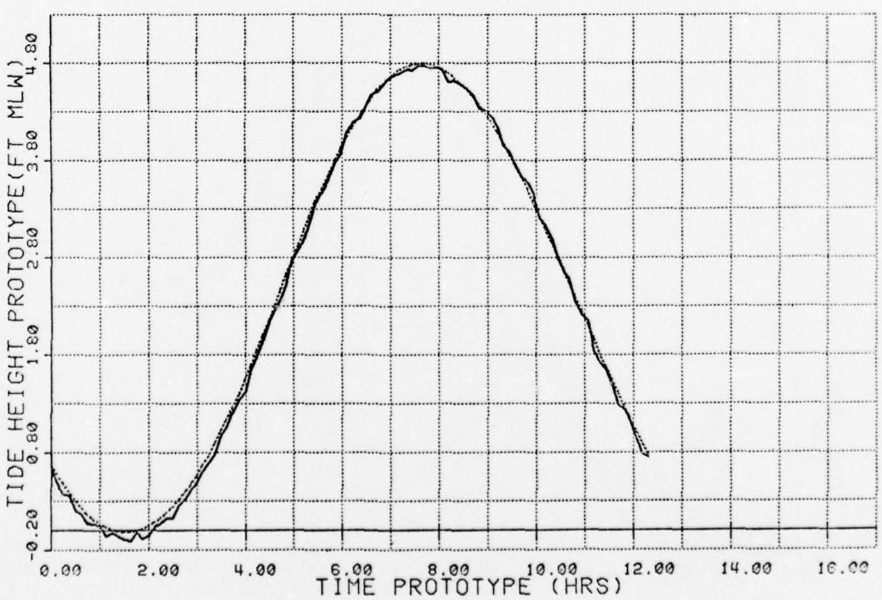


GAGE 8

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

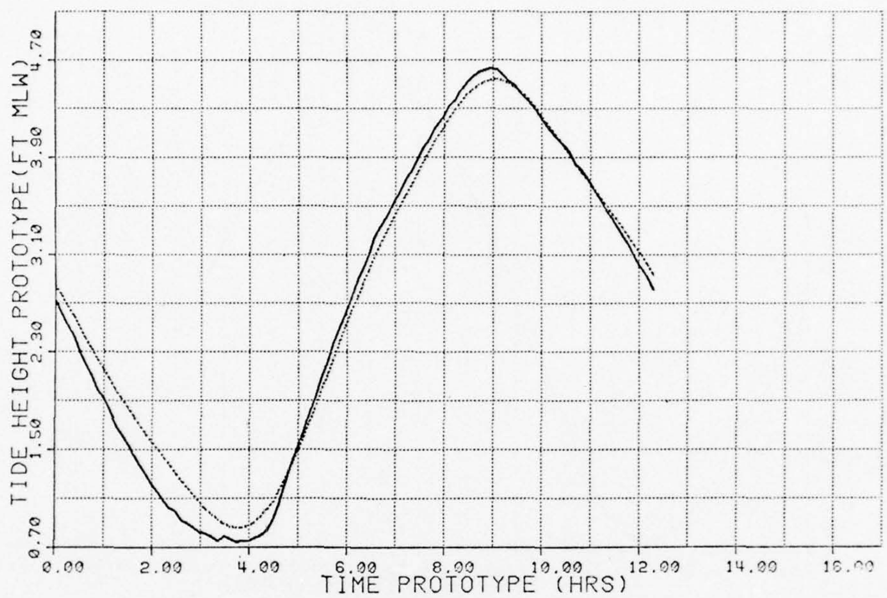
LEGEND

········ BASE

———— PLAN 1C

EFFECTS OF PLAN 1C ON TIDAL ELEVATIONS

GAGES 7 AND 8



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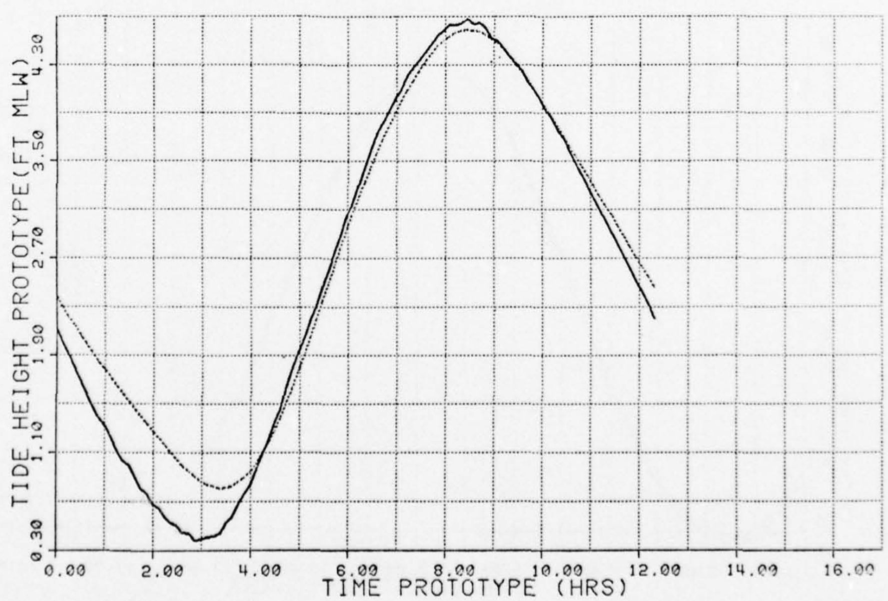


GAGE 2

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

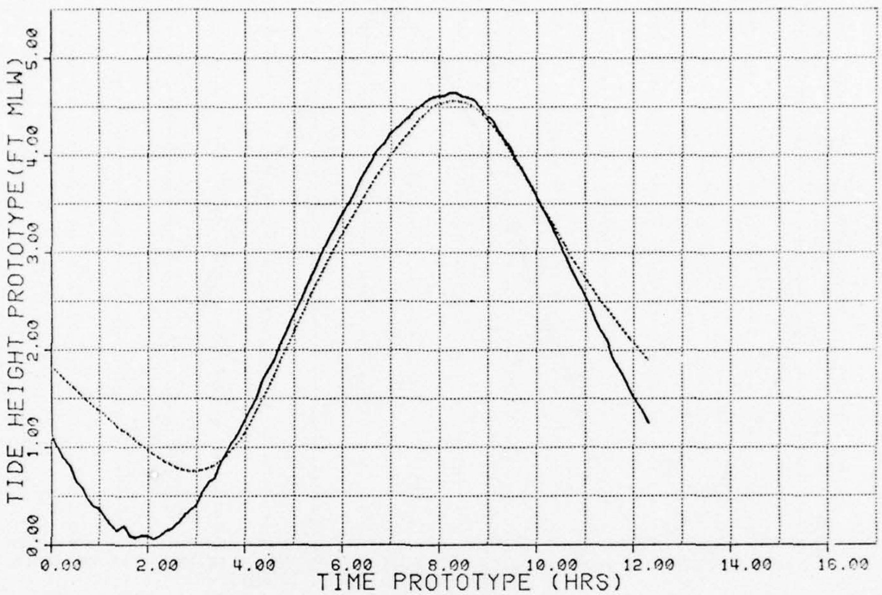
LEGEND

.... BASE

———— PLAN 1C

EFFECTS OF PLAN 7A ON TIDAL ELEVATIONS

GAGES 1 AND 2



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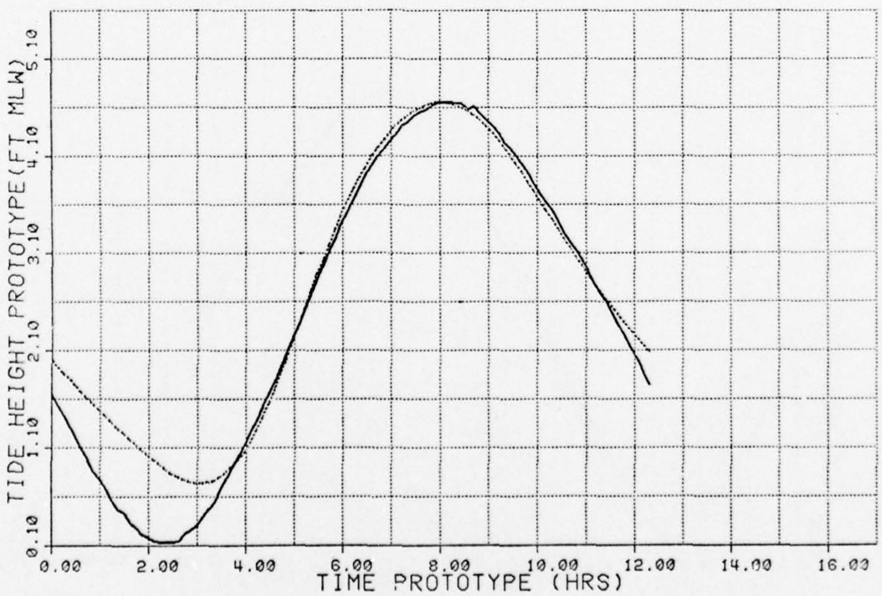


GAGE 4

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

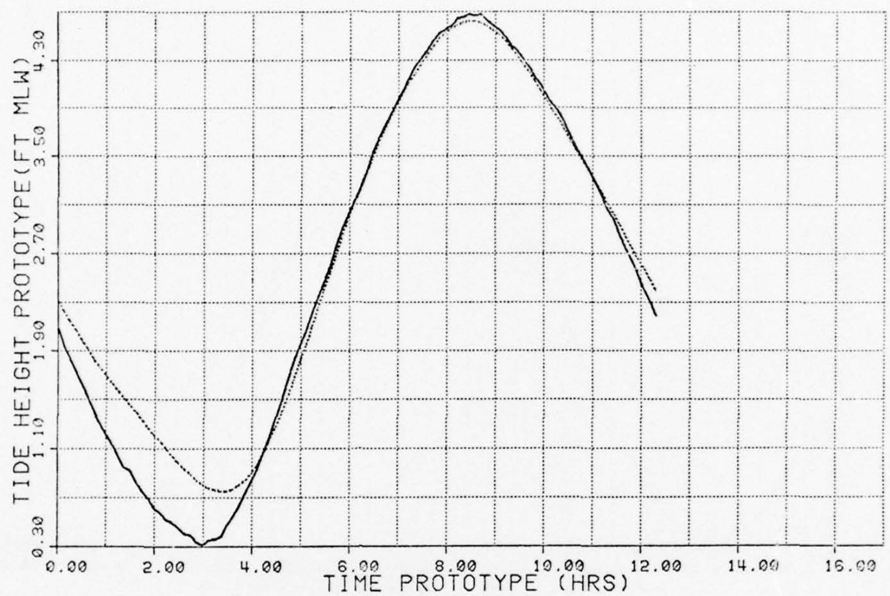
LEGEND

.... BASE

———— PLAN 1C

EFFECTS OF PLAN 7A ON TIDAL ELEVATIONS

GAGES 3 AND 4



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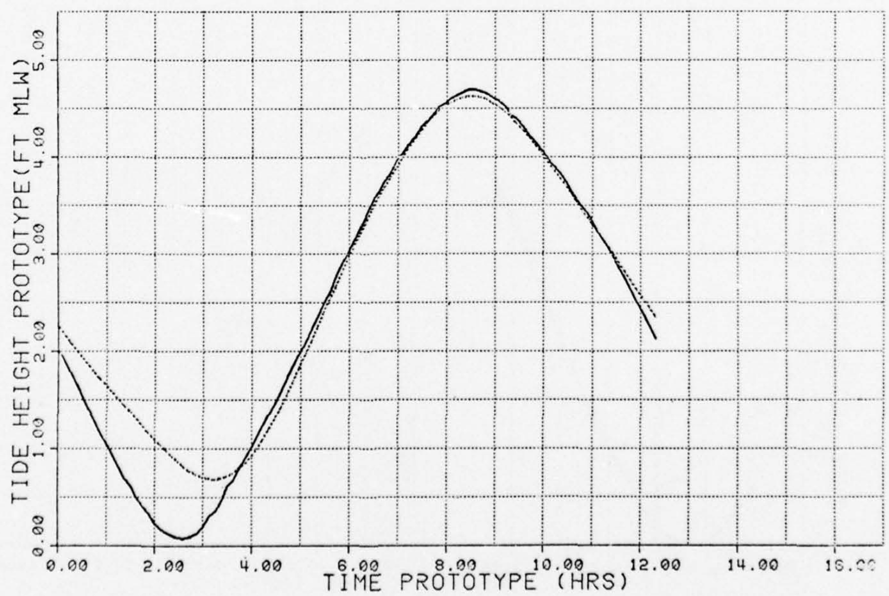


GAGE 6

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

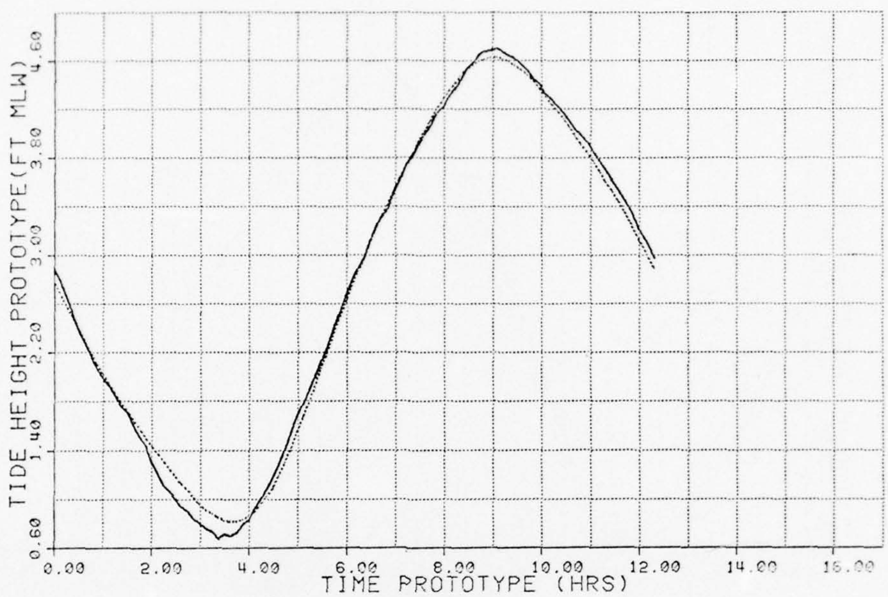
LEGEND

··········· BASE

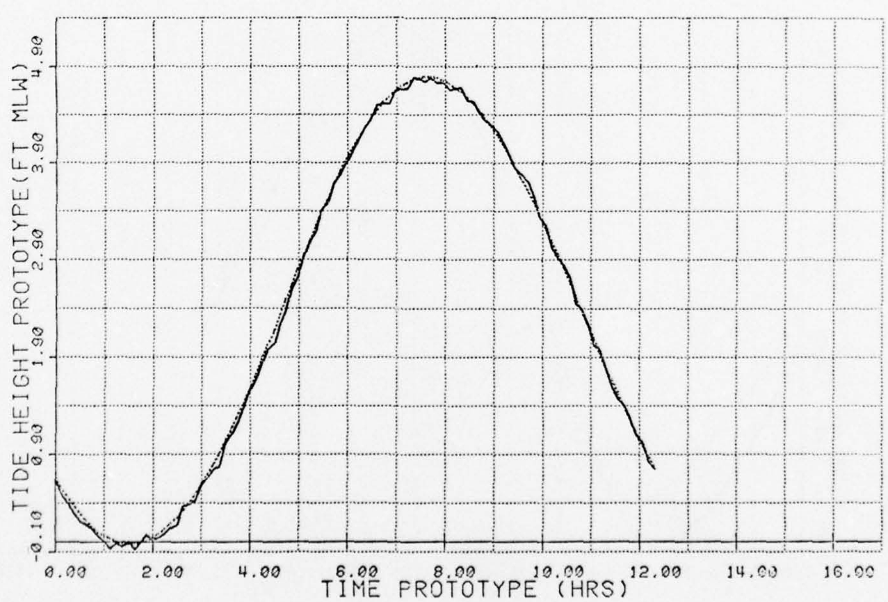
——— PLAN 1C

EFFECTS OF PLAN 7A ON TIDAL ELEVATIONS

GAGES 5 AND 6



GAGE 7



GAGE 8

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

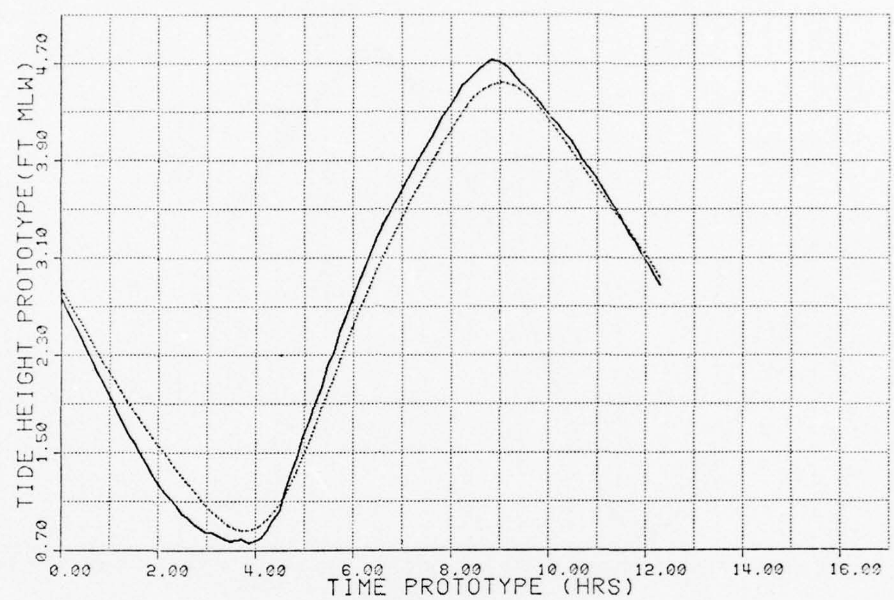
LEGEND

.... BASE

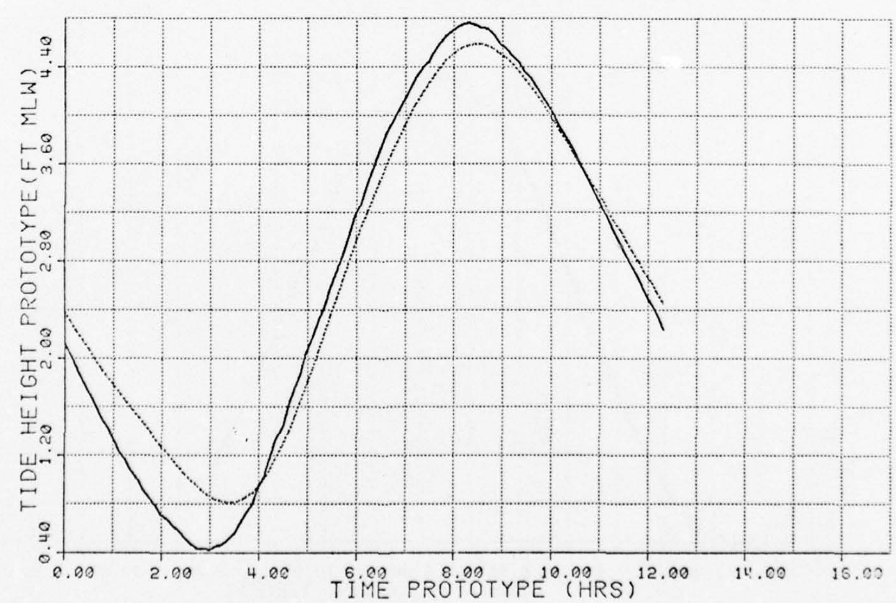
———— PLAN 1C

EFFECTS OF PLAN 7A ON TIDAL ELEVATIONS

GAGES 7 AND 8



GAGE 1



GAGE 2

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

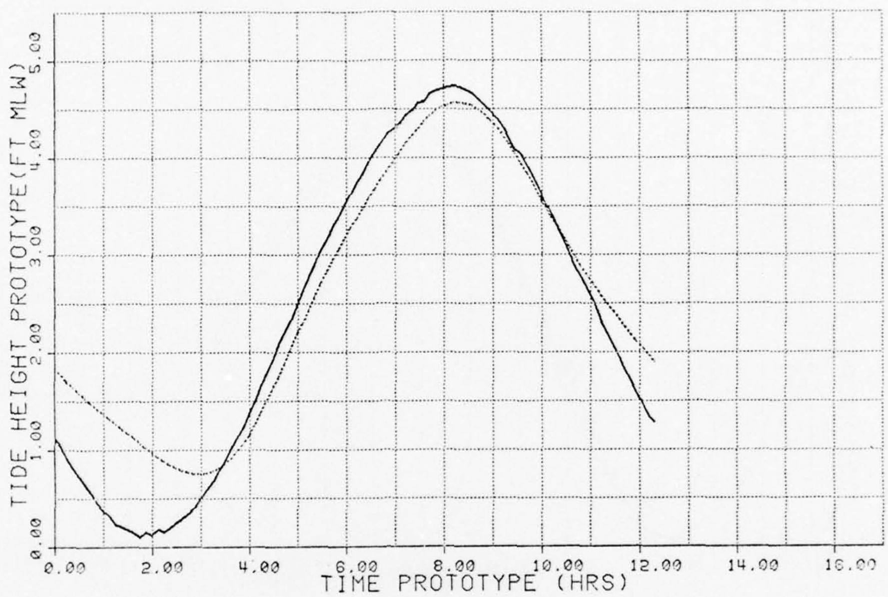
LEGEND

BASE

PLAN 1C

EFFECTS OF PLAN 7B ON TIDAL ELEVATIONS

GAGES 1 AND 2



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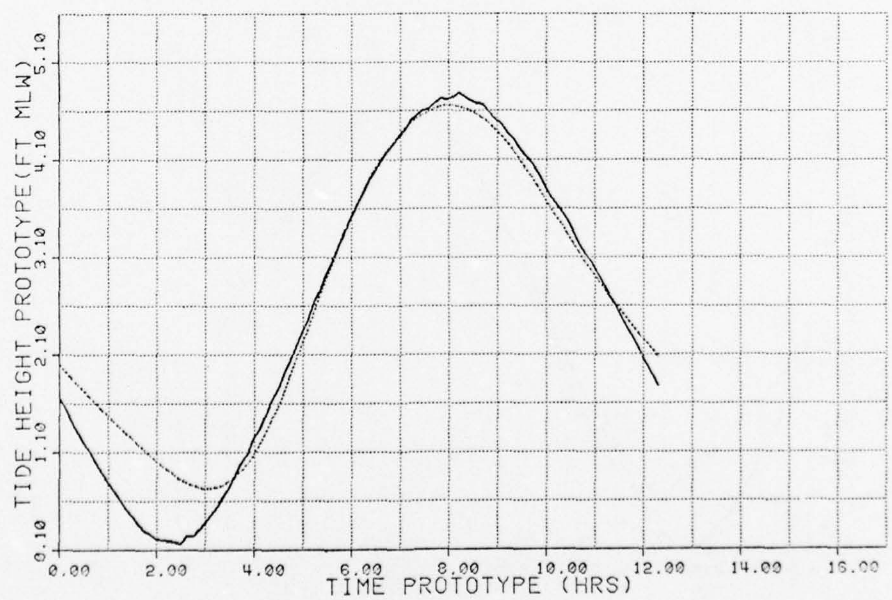


GAGE 4

TEST CONDITIONS

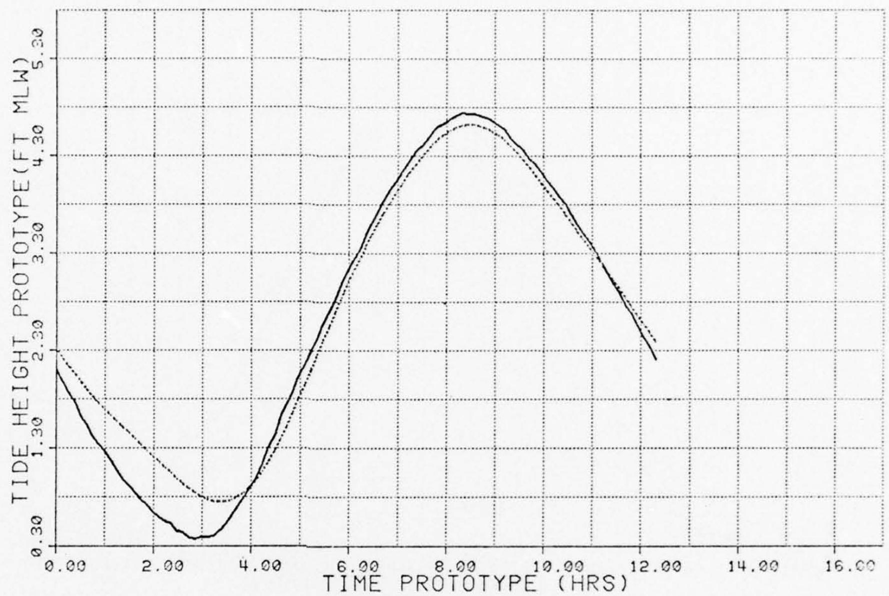
OCEAN TIDE RANGE 4.8 FT

LEGEND

BASE

PLAN 1C

EFFECTS OF PLAN 7B
ON TIDAL ELEVATIONS
GAGES 3 AND 4



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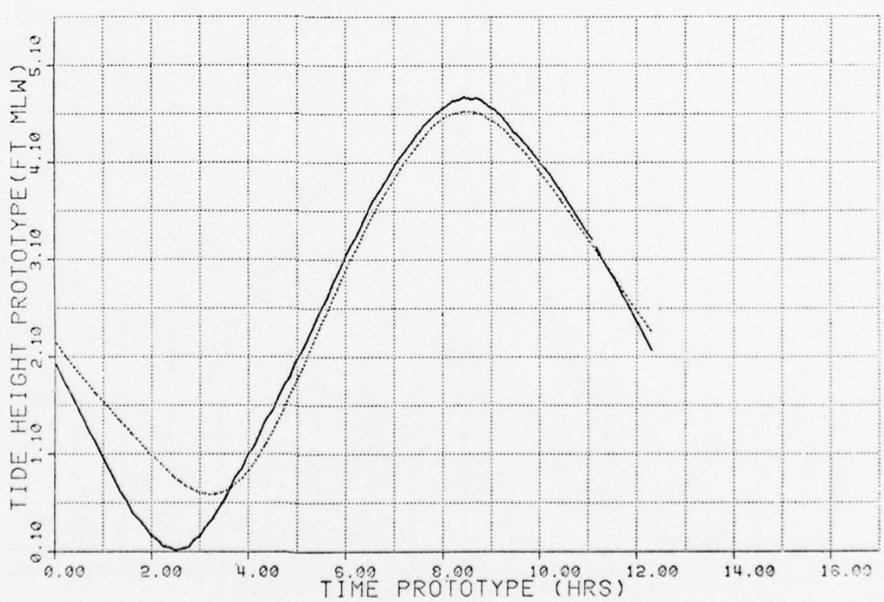


GAGE 6

TEST CONDITIONS

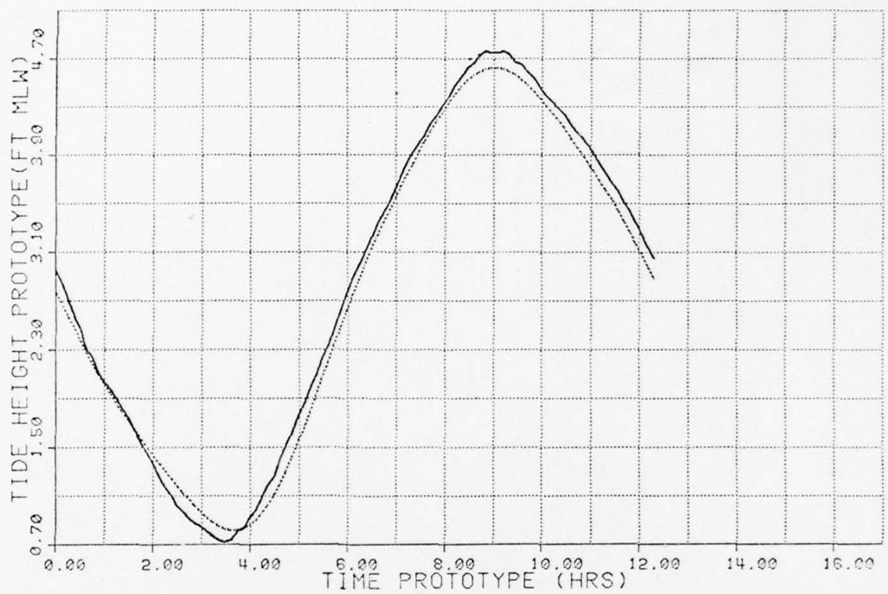
OCEAN TIDE RANGE 4.8 FT

LEGEND

.... BASE

———— PLAN 1C

EFFECTS OF PLAN 7B
ON TIDAL ELEVATIONS
GAGES 5 AND 6



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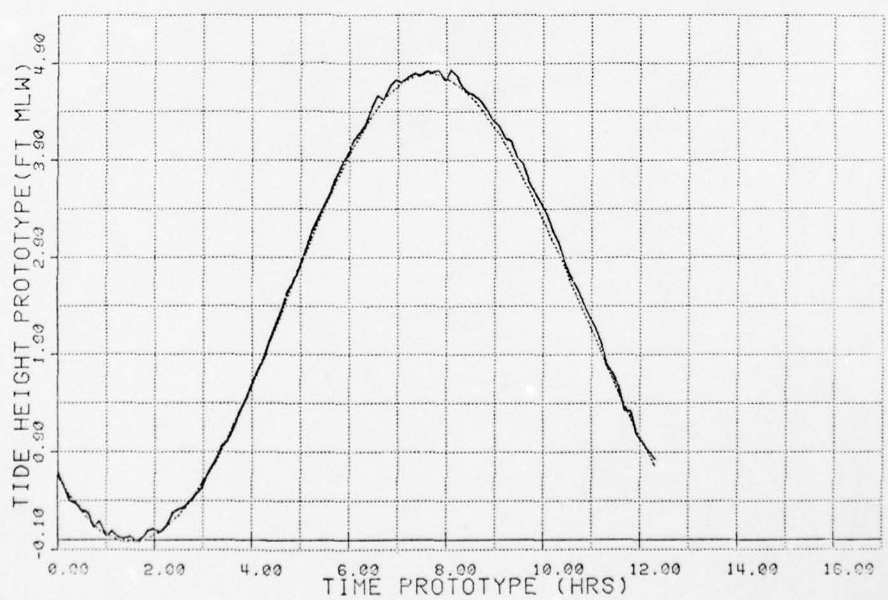


GAGE 8

TEST CONDITIONS

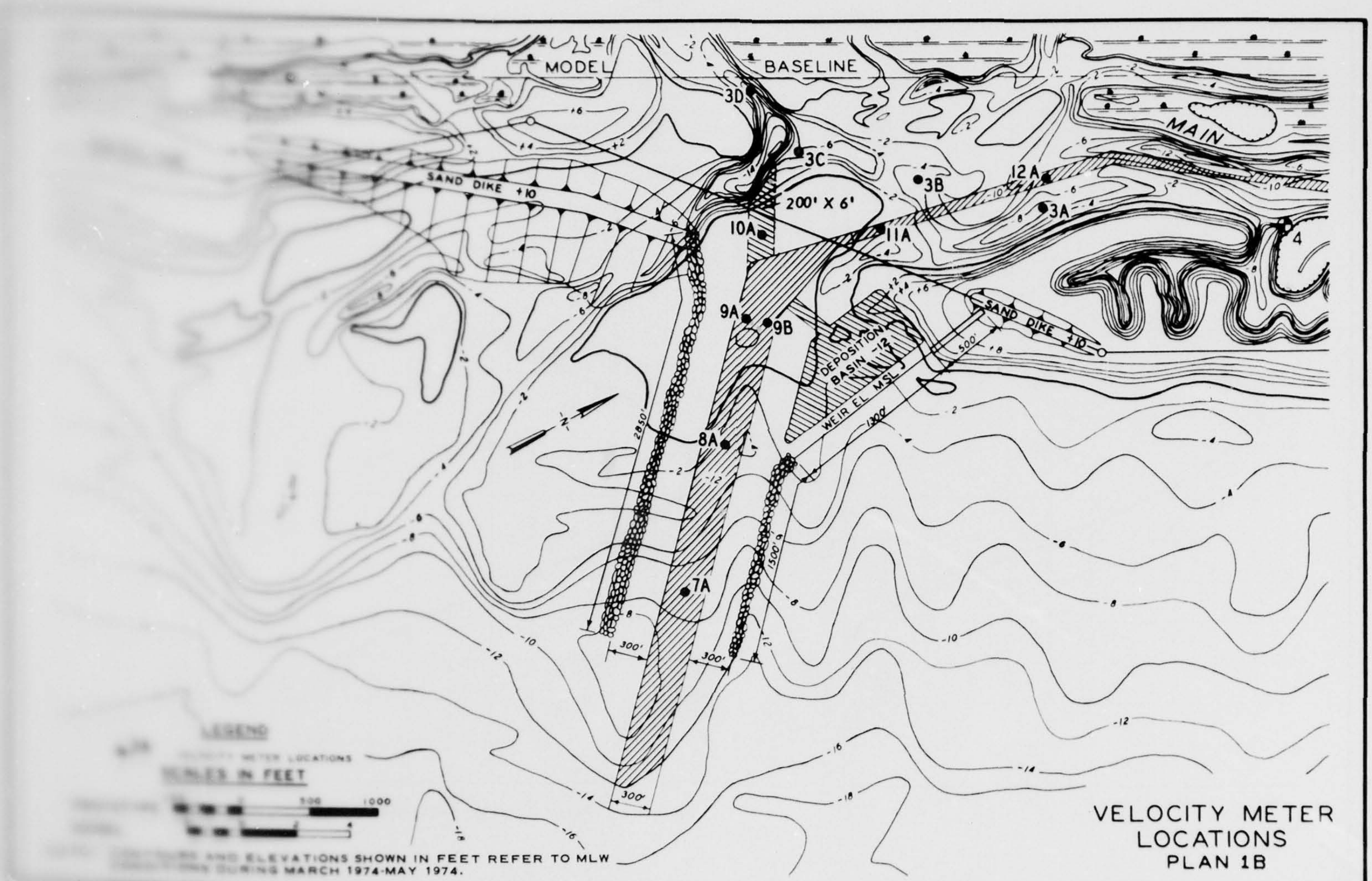
OCEAN TIDE RANGE 4.8 FT

LEGEND

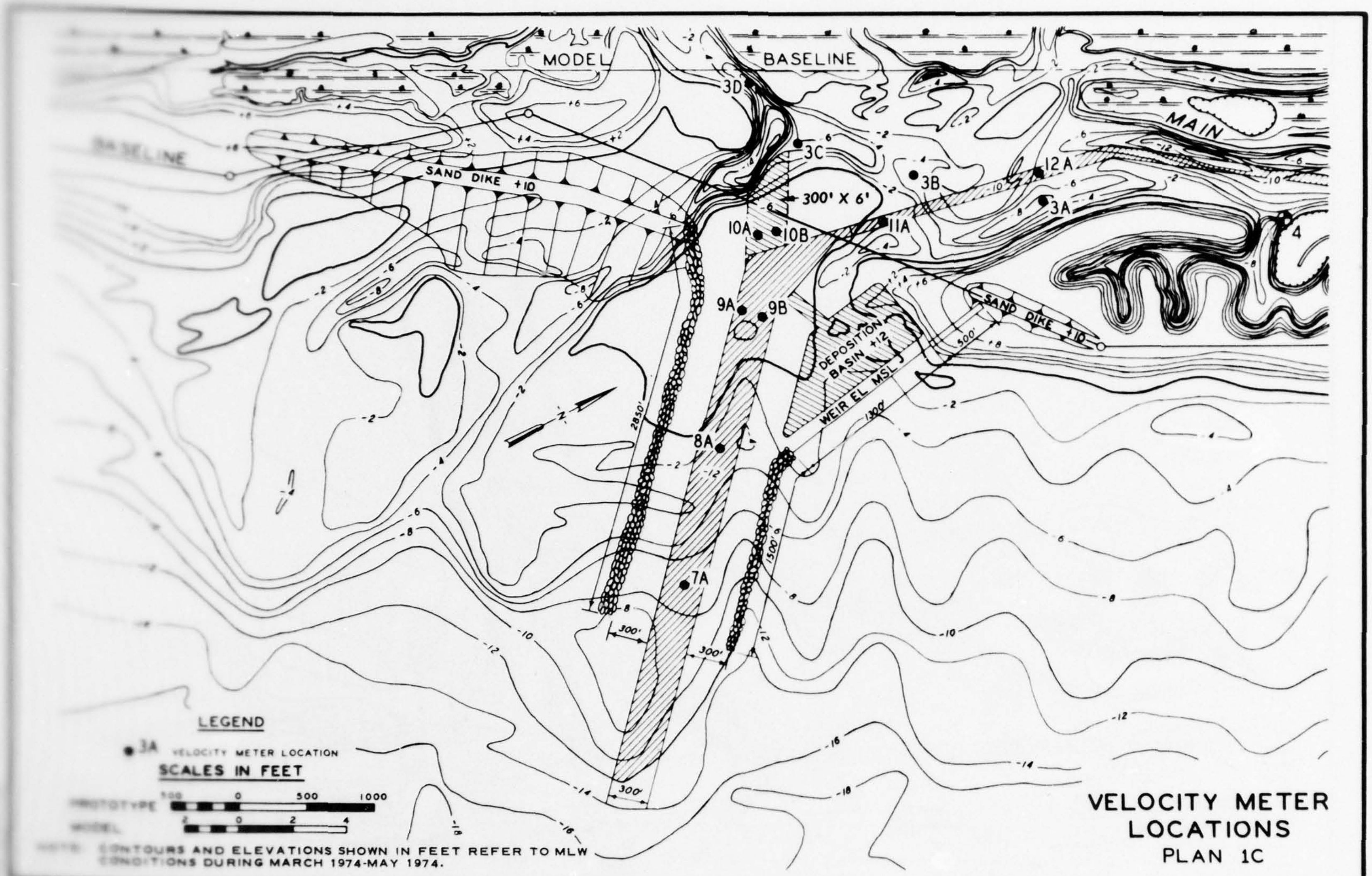
.... BASE

——— PLAN 1C

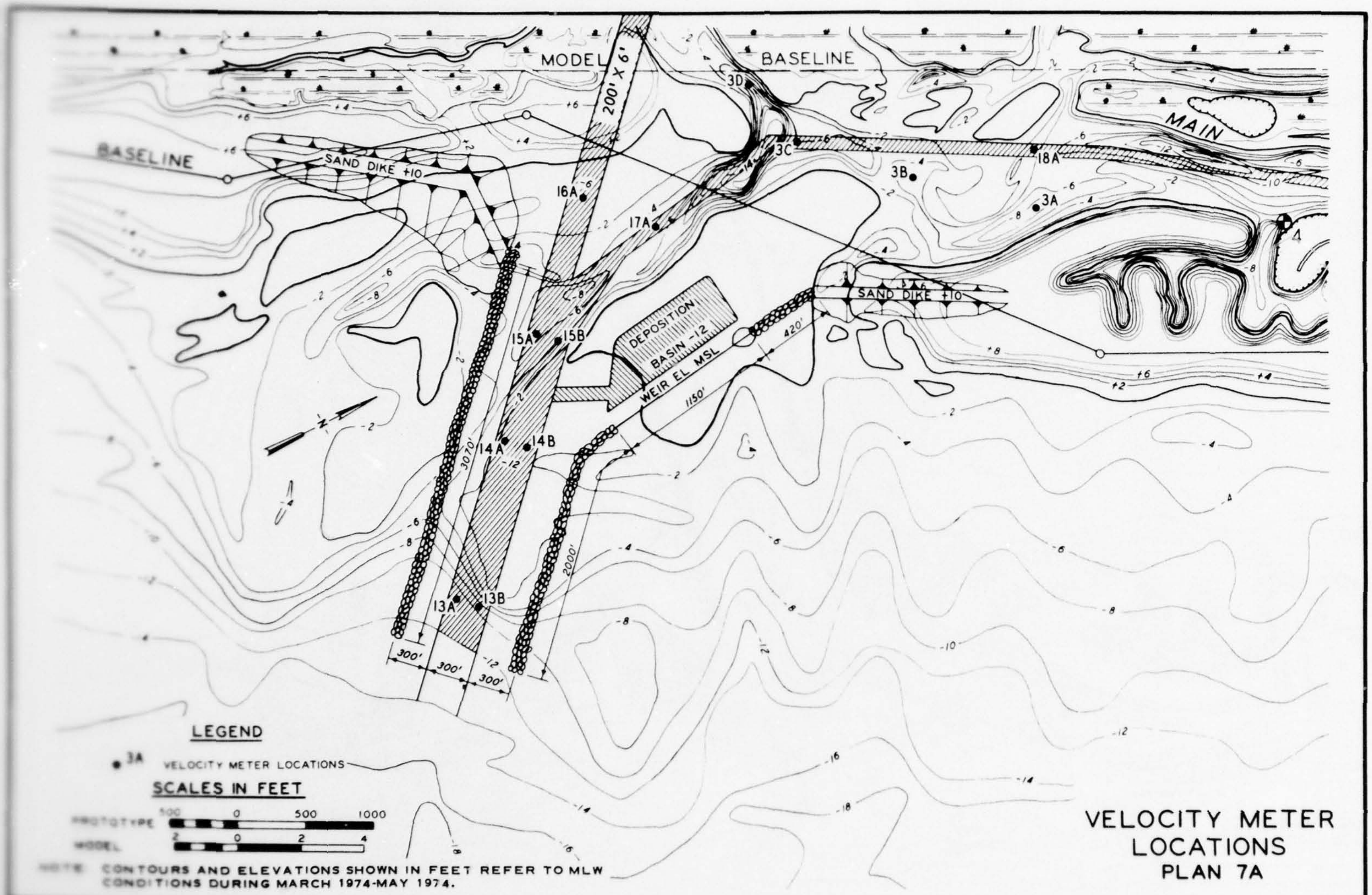
EFFECTS OF PLAN 7B
ON TIDAL ELEVATIONS
GAGES 7 AND 8



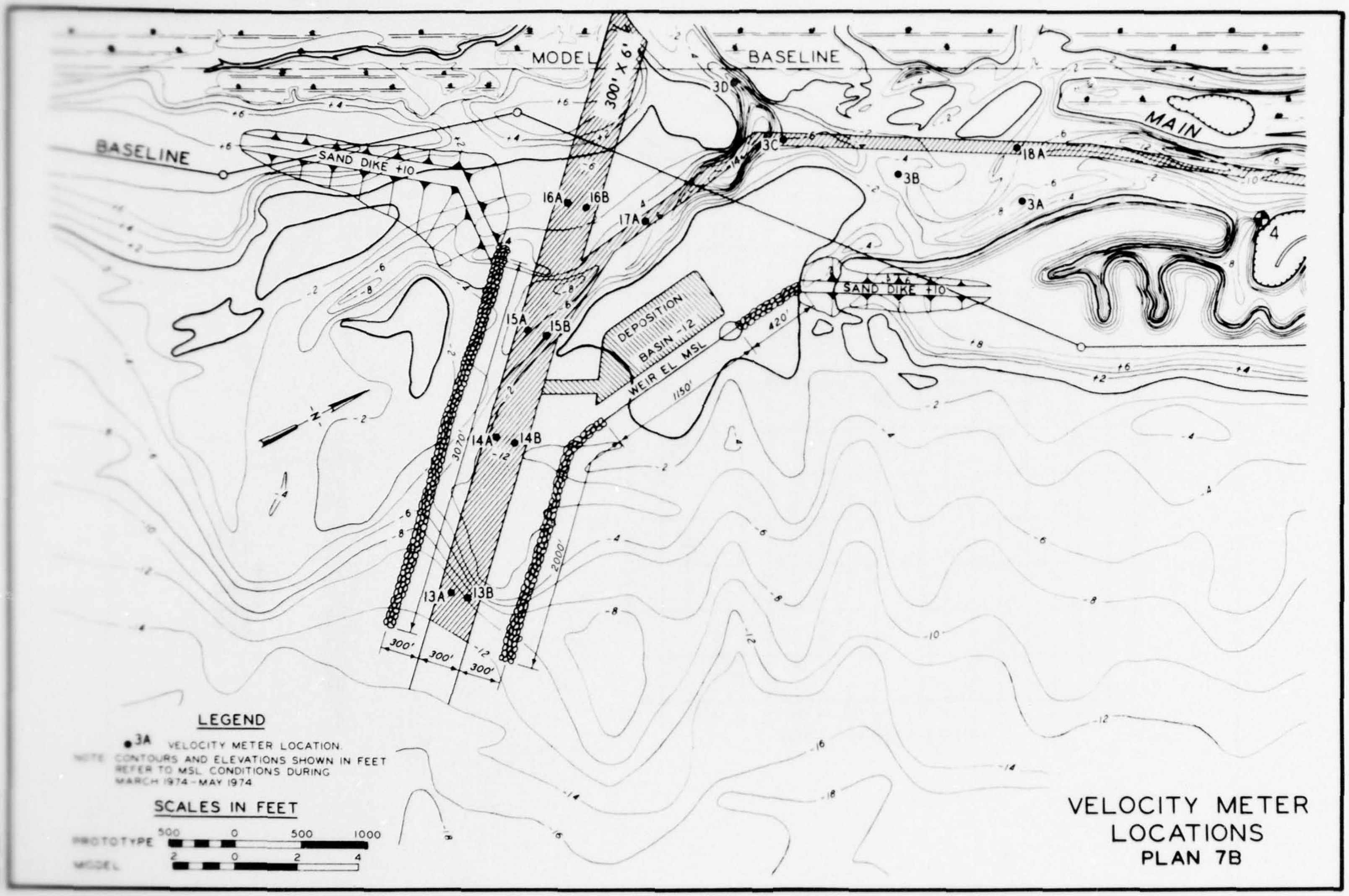
VELOCITY METER
LOCATIONS
PLAN 1B



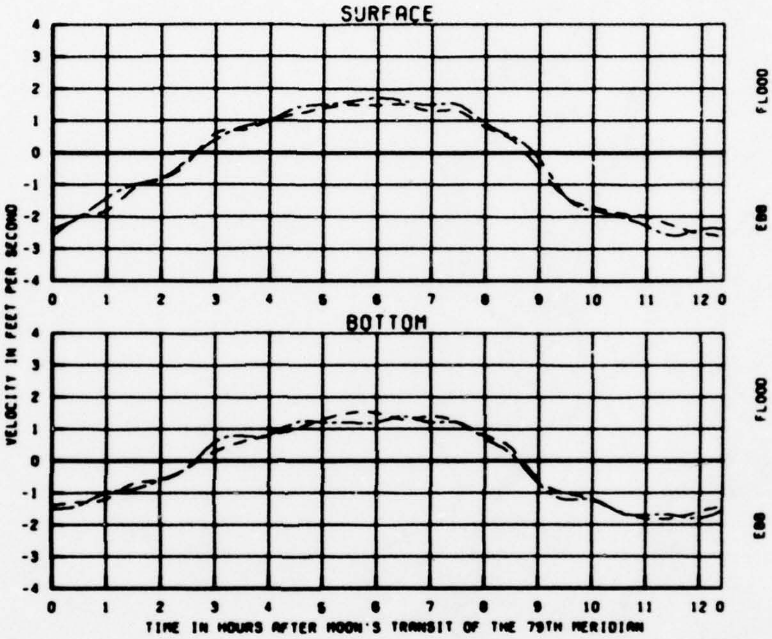
VELOCITY METER LOCATIONS
PLAN 1C



VELOCITY METER LOCATIONS
PLAN 7A



VELOCITY METER
LOCATIONS
PLAN 7B

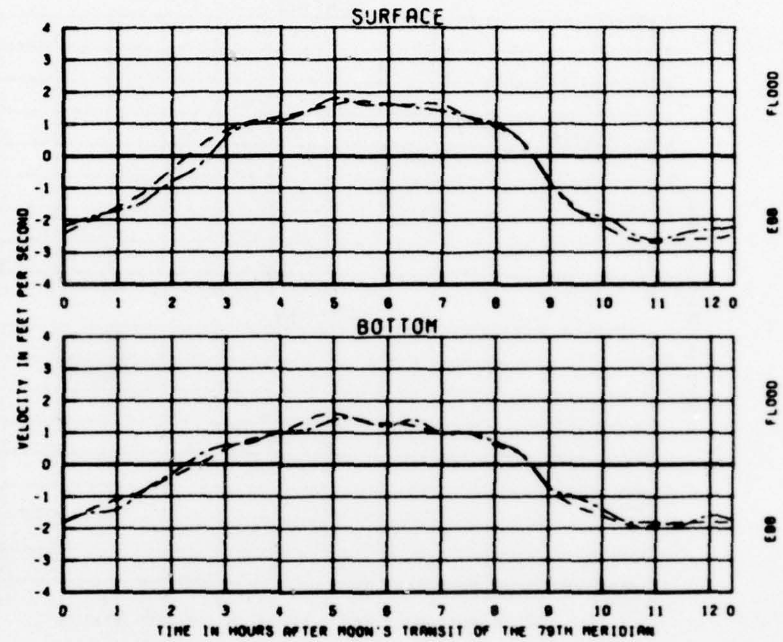


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1B – – –
PLAN 1C —·—

EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES

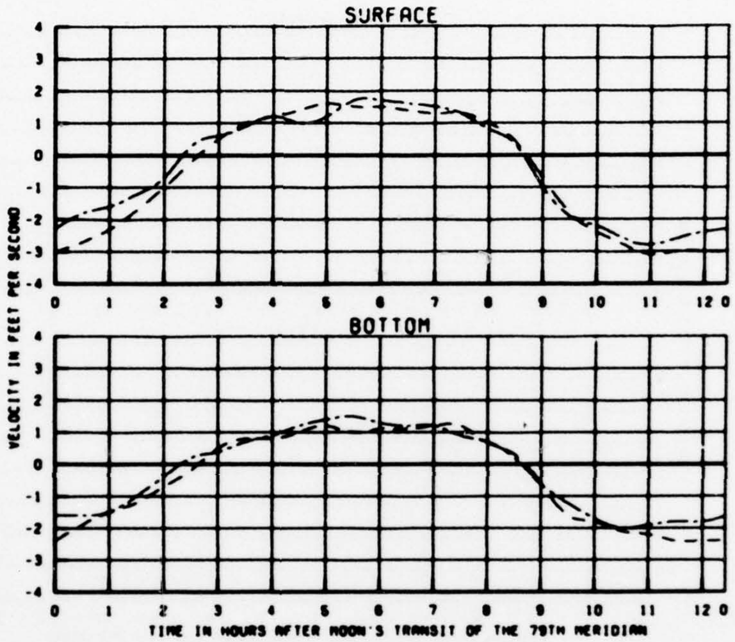
STATION
7A



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1B – – –
PLAN 1C —·—

EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES
STATION
8A

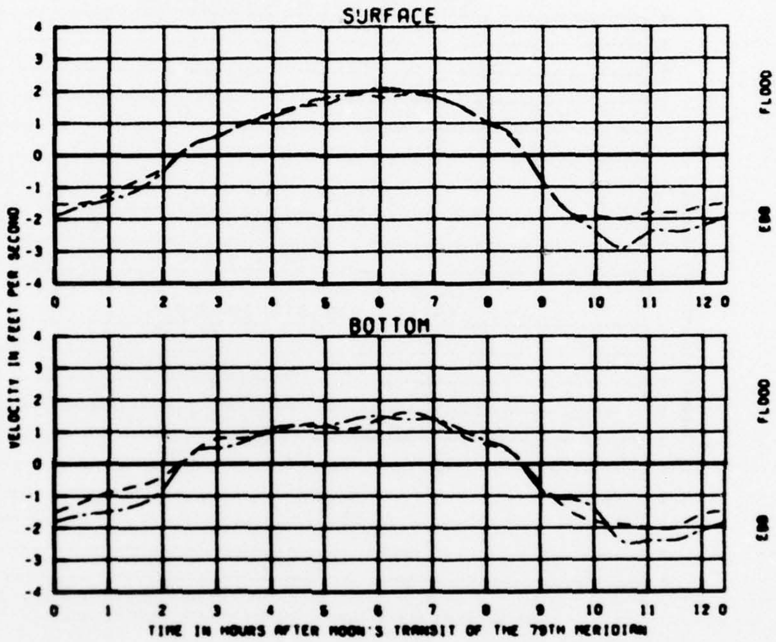


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.0 FEET

LEGEND
BASE ———
PLAN 1B — — —
PLAN 1C —·—

EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES

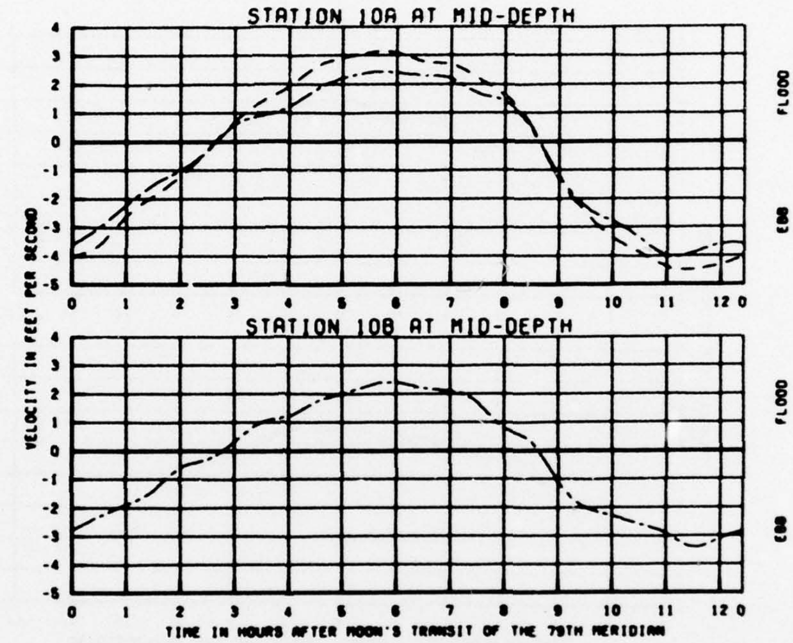
STATION
9A



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.0 FEET

LEGEND
BASE
PLAN 1B
PLAN 1C

EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES
STATION
98

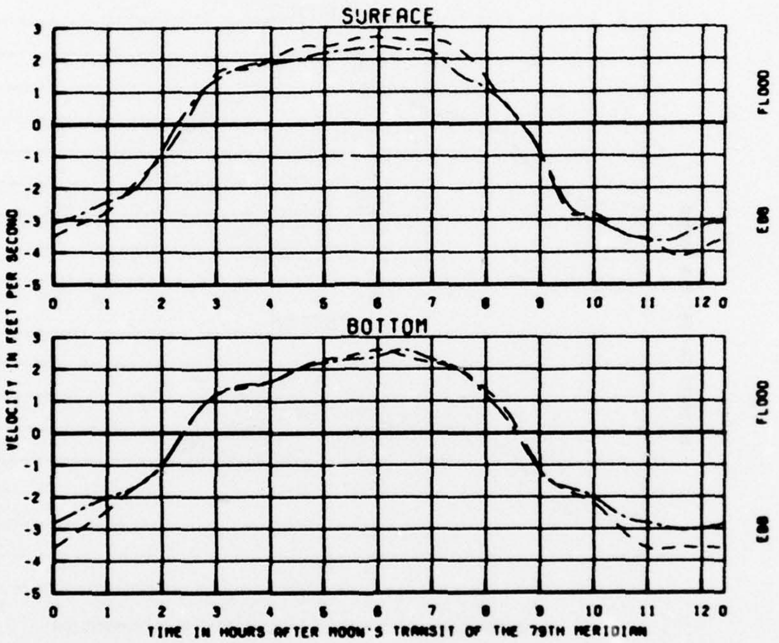


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.0 FEET

LEGEND
BASE ———
PLAN 1B – – –
PLAN 1C —·—

EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES

STATIONS
10A AND 10B

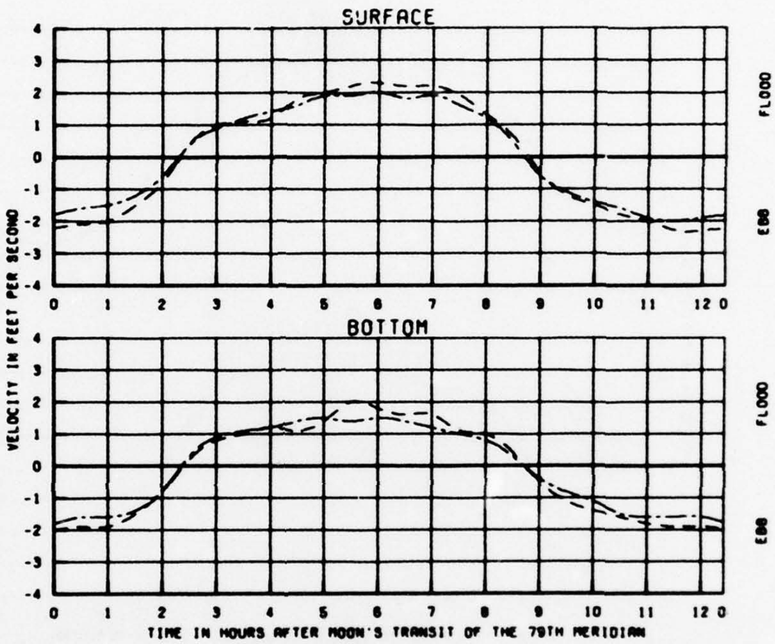


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE
PLAN 1B
PLAN 1C

EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES

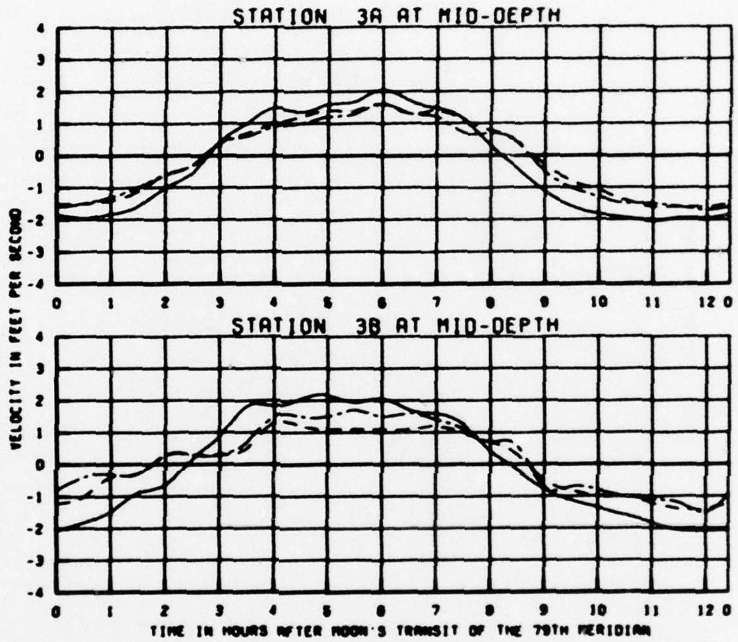
STATION
11A



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ————
PLAN 1B — — —
PLAN 1C —·—

EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES
STATION
12A

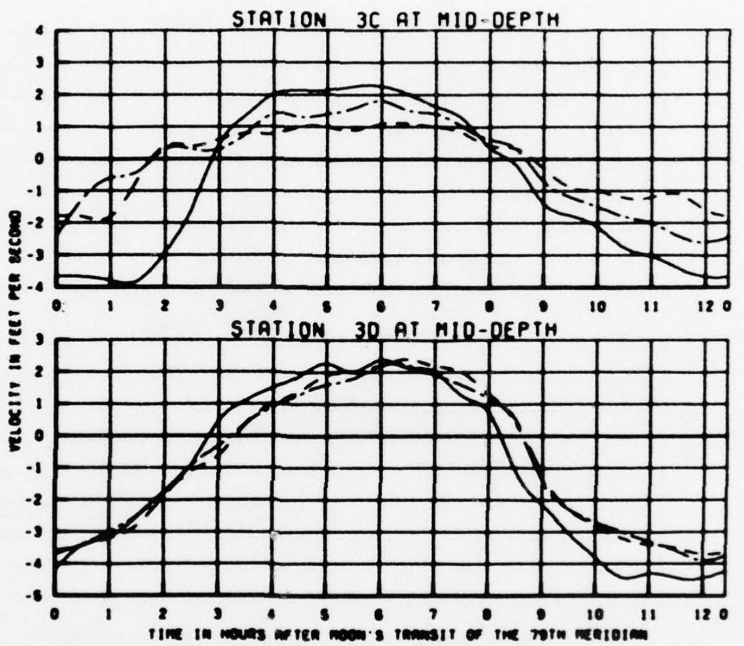


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1B — — —
PLAN 1C —·—

EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES

STATIONS
3A AND 3B

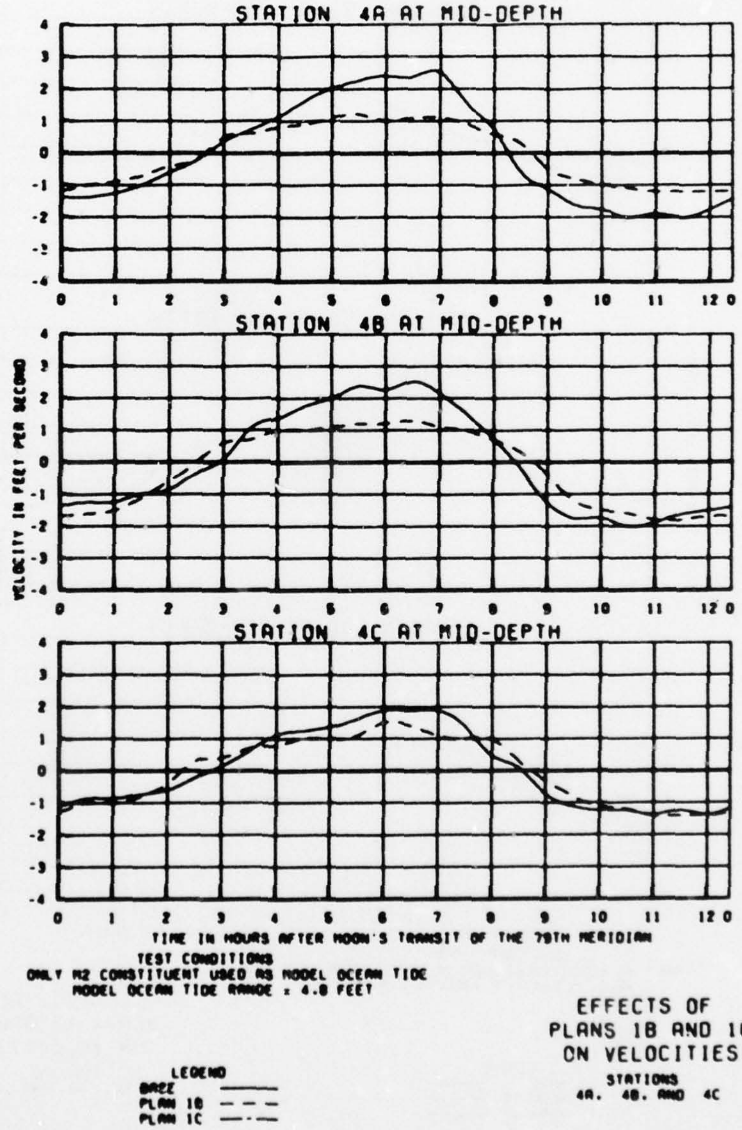


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1B – – –
PLAN 1C —·—

EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES

STATIONS
3C AND 3D



EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES

STATIONS
4A, 4B, AND 4C

AD-A054 242 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 8/3
IMPROVEMENTS FOR MURRELLS INLET, SOUTH CAROLINA. HYDRAULIC MODE--ETC(U)
APR 78 F C PERRY, W C SEABERGH, E F LANE

UNCLASSIFIED WES-TR-H-78-4 NL

4 OF 4
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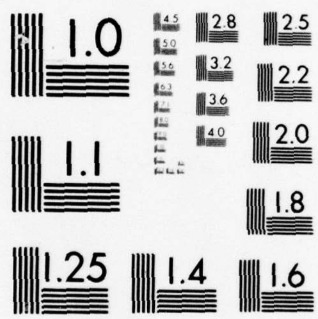


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

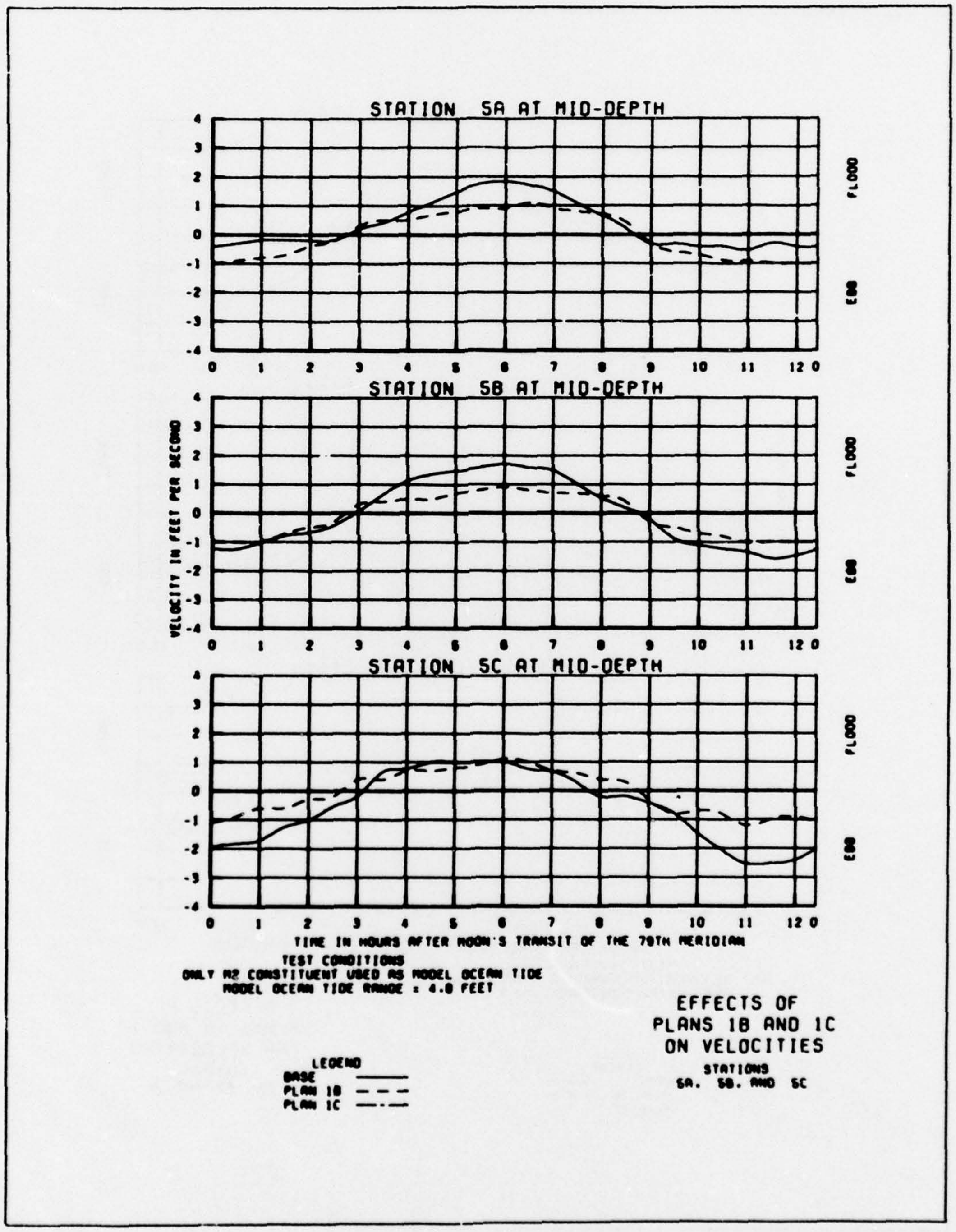
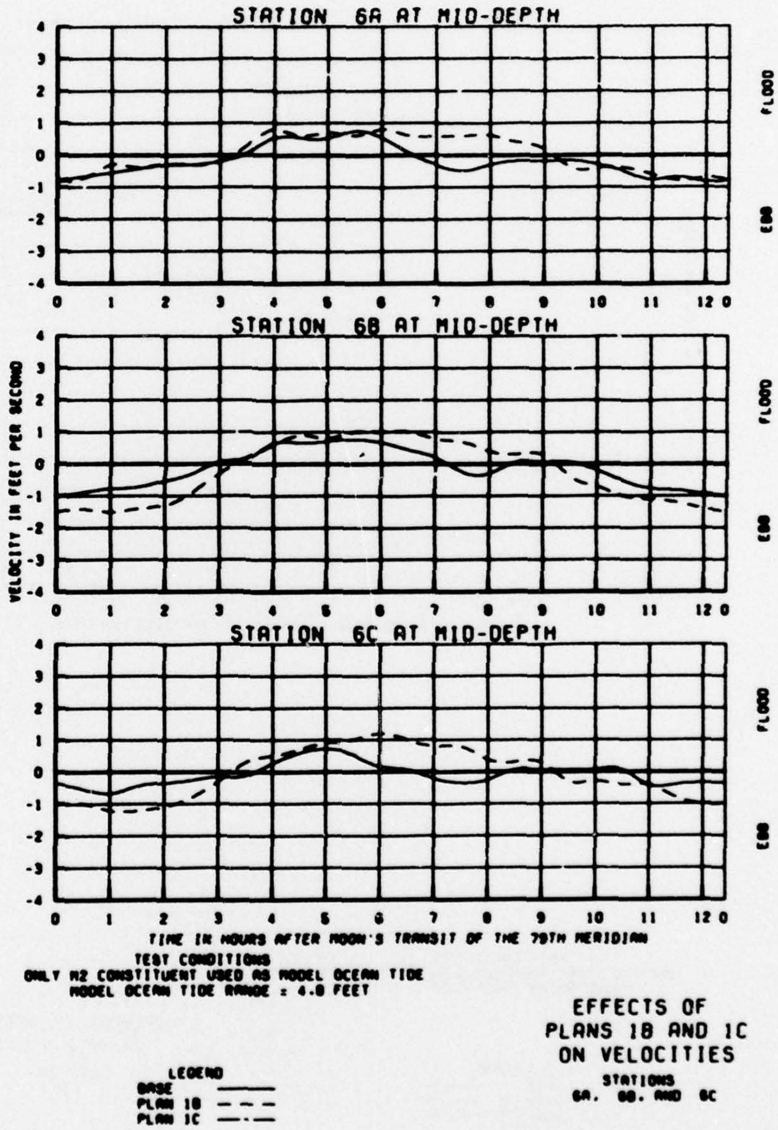
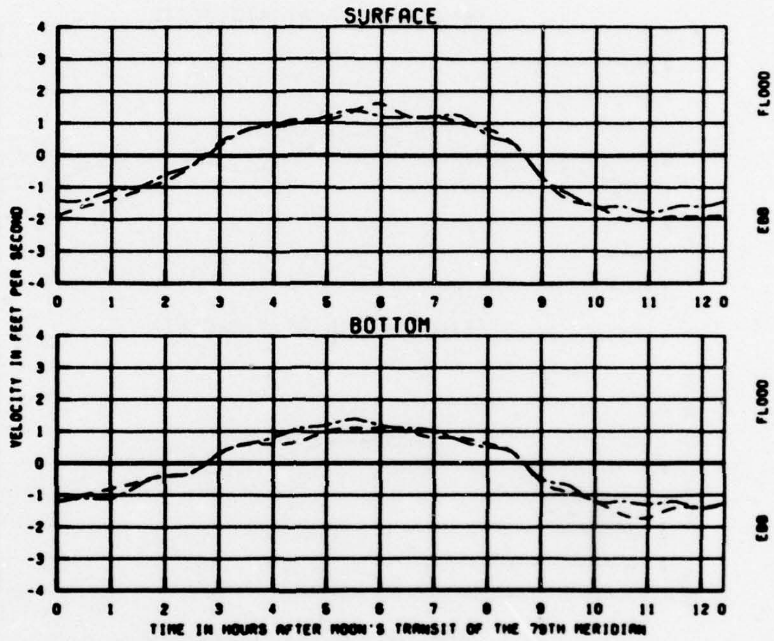

STATION 5A AT MID-DEPTH
STATION 5B AT MID-DEPTH
STATION 5C AT MID-DEPTH
VELOCITY IN FEET PER SECOND
FLOOD
EBB
TIME IN HOURS AFTER MOON'S TRANSIT OF THE 79TH MERIDIAN
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.0 FEET
LEGEND
BASE
PLAN 1B
PLAN 1C
EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES
STATIONS
5A, 5B, AND 5C

PLATE 88



EFFECTS OF
PLANS 1B AND 1C
ON VELOCITIES

STATIONS
6A, 6B, AND 6C

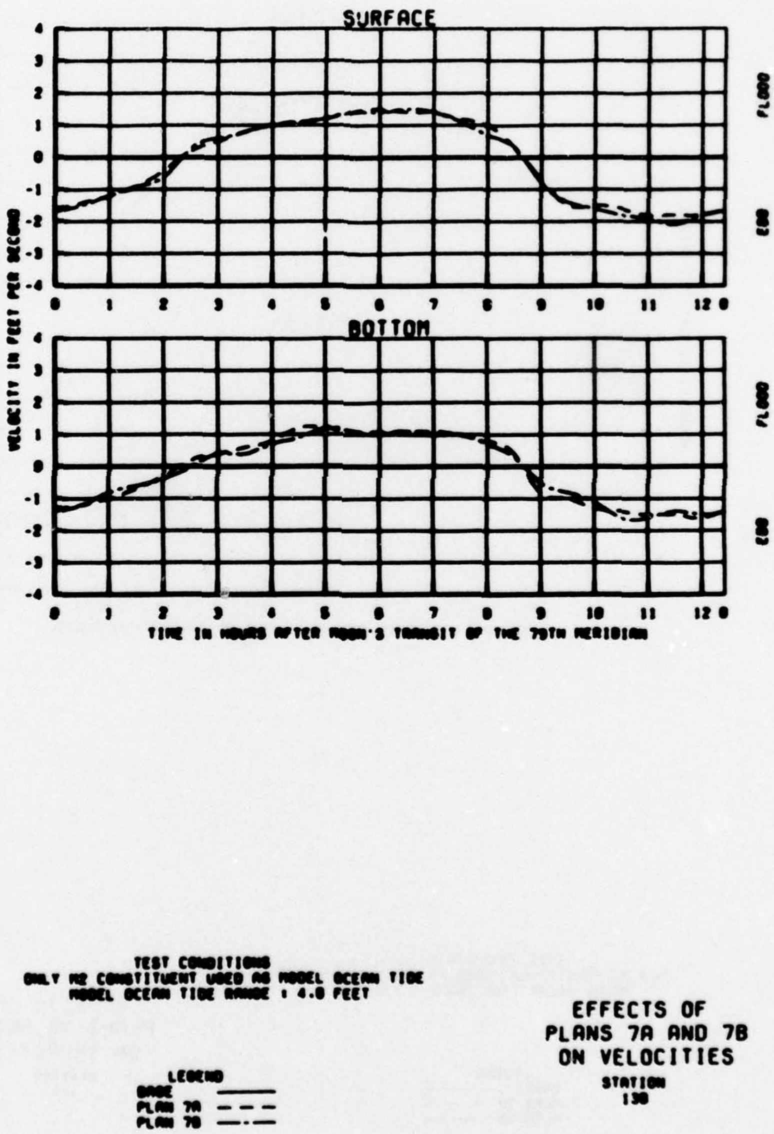


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

LEGEND
BASE
PLAN 7A
PLAN 7B

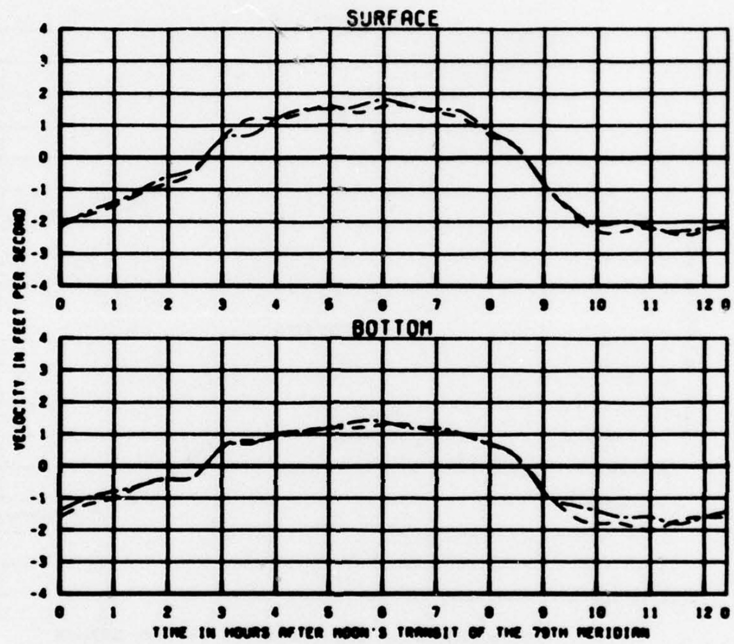
EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

STATION
13A



EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

STATION
13B



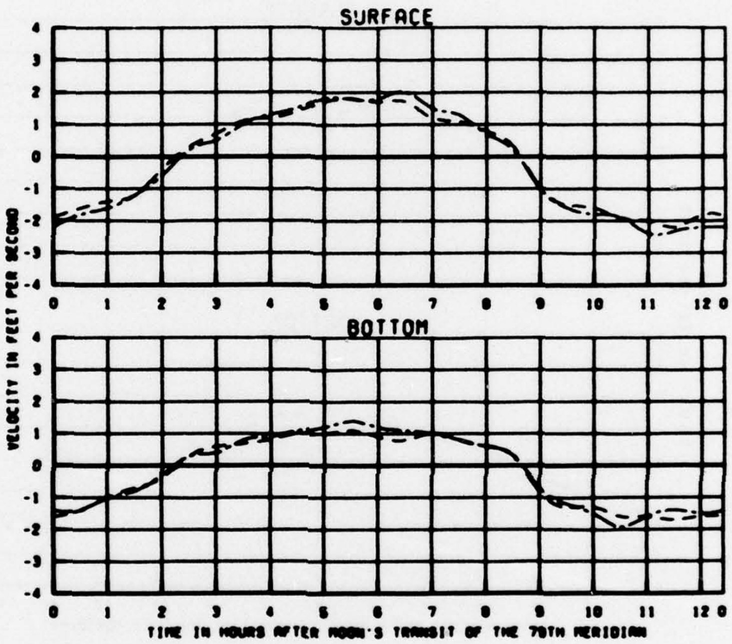
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

LEGEND
BASE ———
PLAN 7A — — —
PLAN 7B —·—

EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

STATION
14A

PLATE 92

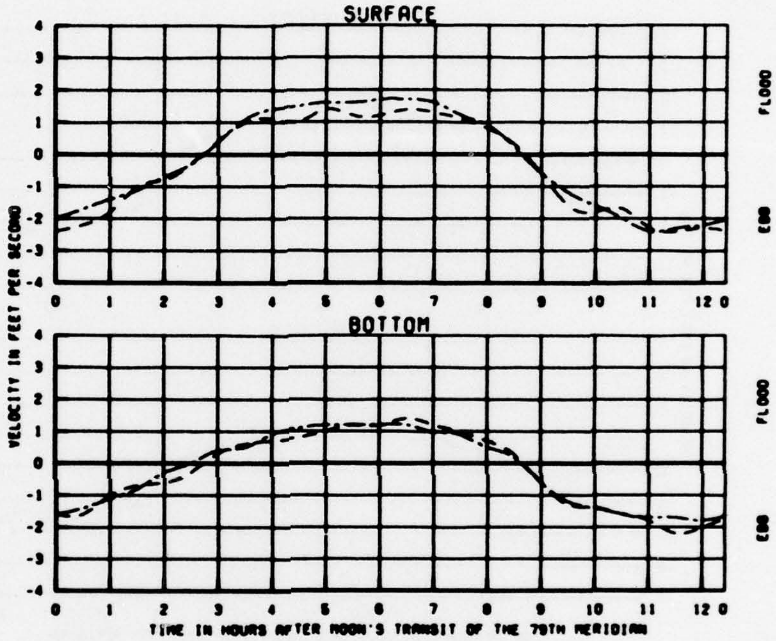


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

LEGEND
BASE
PLAN 7A
PLAN 7B

EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

STATION
140



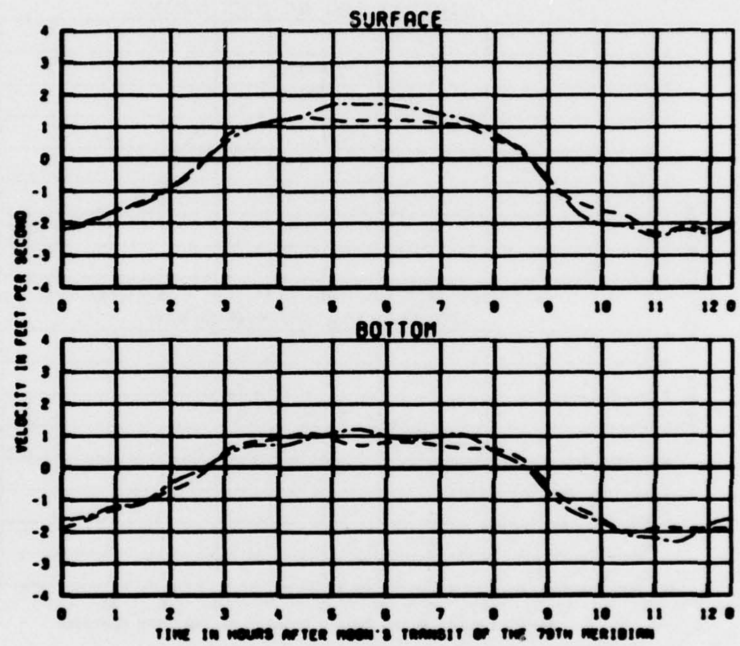
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

LEGEND
BASE ————
PLAN 7A — — —
PLAN 7B —·—

EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

STATION
15A

PLATE 94

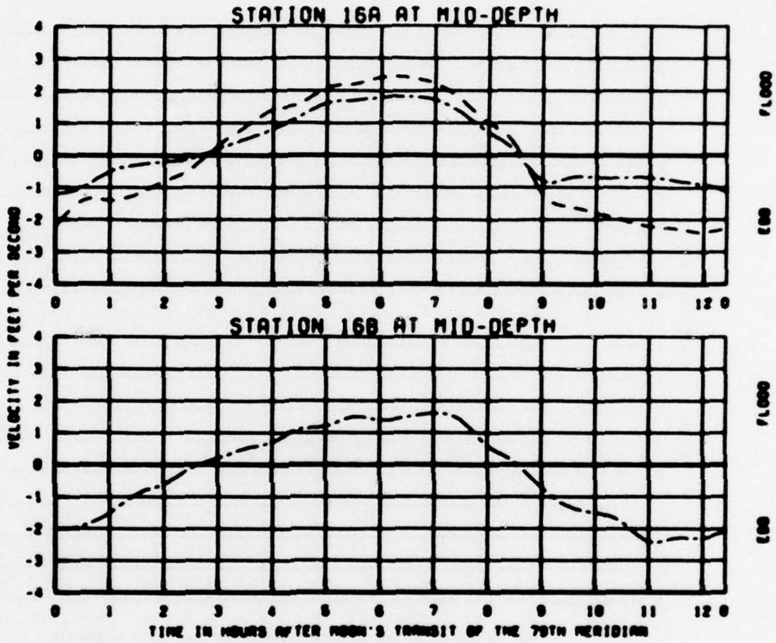


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

LEGEND
BASE
PLAN 7A
PLAN 7B

EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

STATION
150

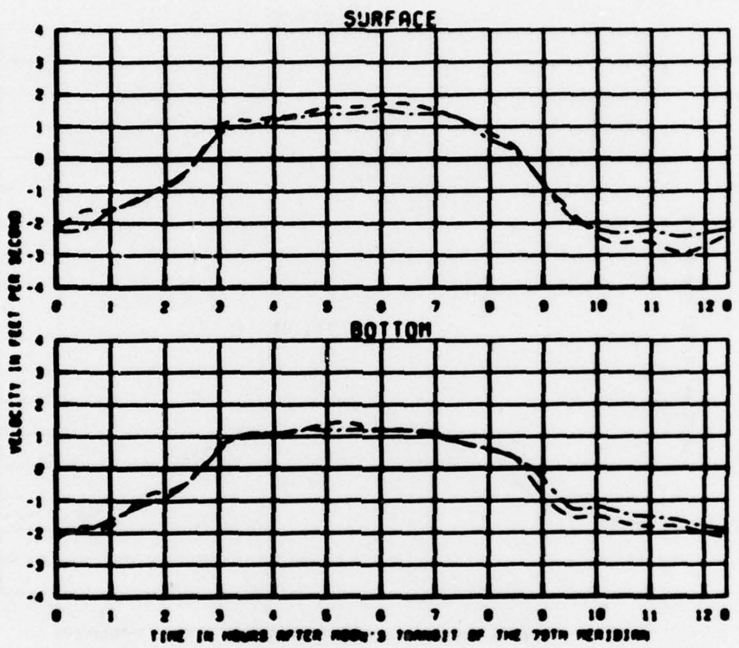


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.8 FEET

LEGEND
BASE
PLAN 7A
PLAN 7B

EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

STATIONS
16A AND 16B

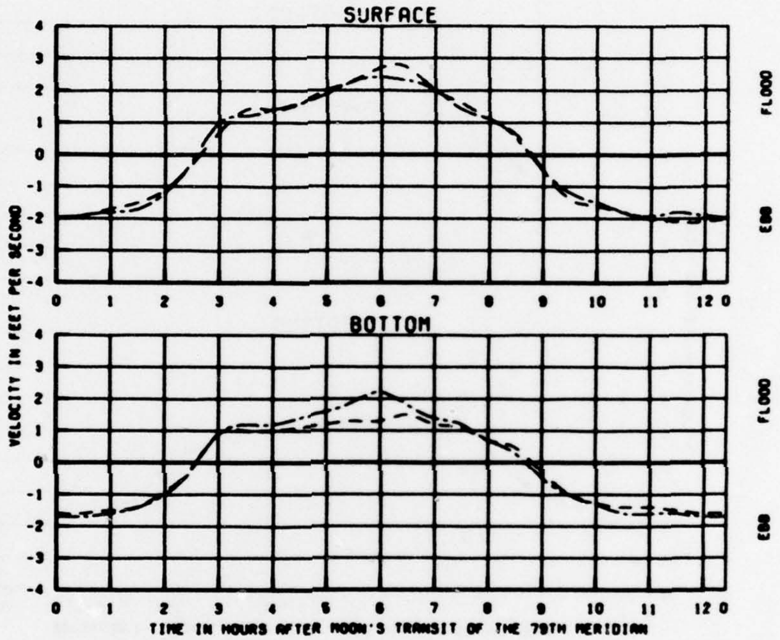


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

LEGEND
BASE ———
PLAN 7A – – –
PLAN 7B —·—

EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

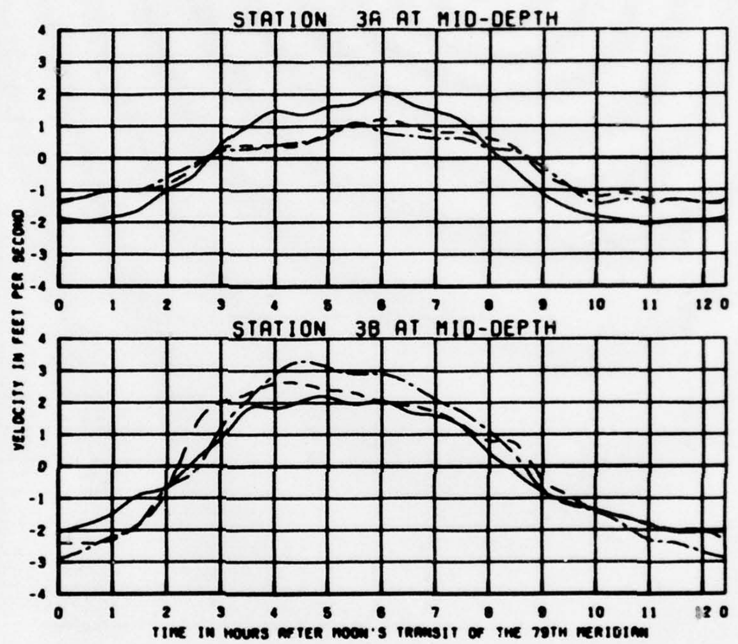
STATION
17A



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

LEGEND
BASE ———
PLAN 7A — — —
PLAN 7B —·—

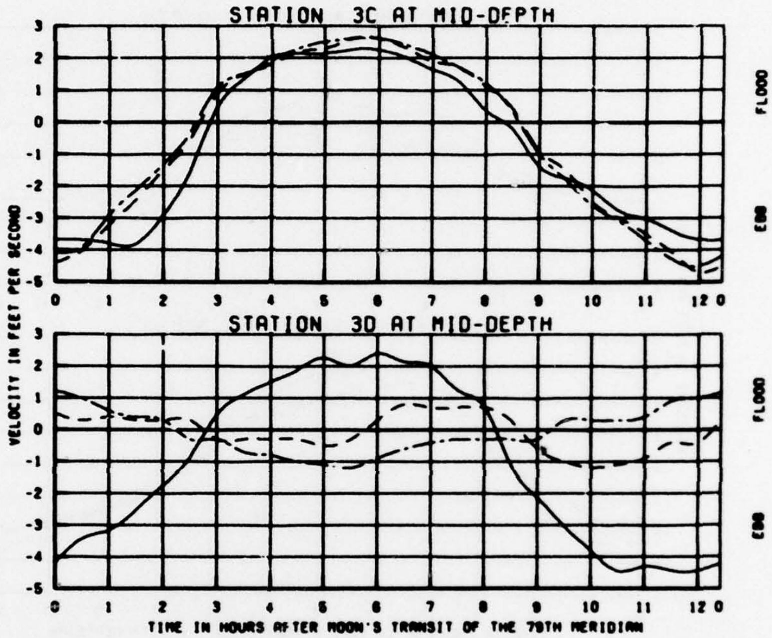
EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES
STATION
18A



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

LEGEND
BASE ———
PLAN 7A — — —
PLAN 7B —·—·—

EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES
STATIONS
3A AND 3B



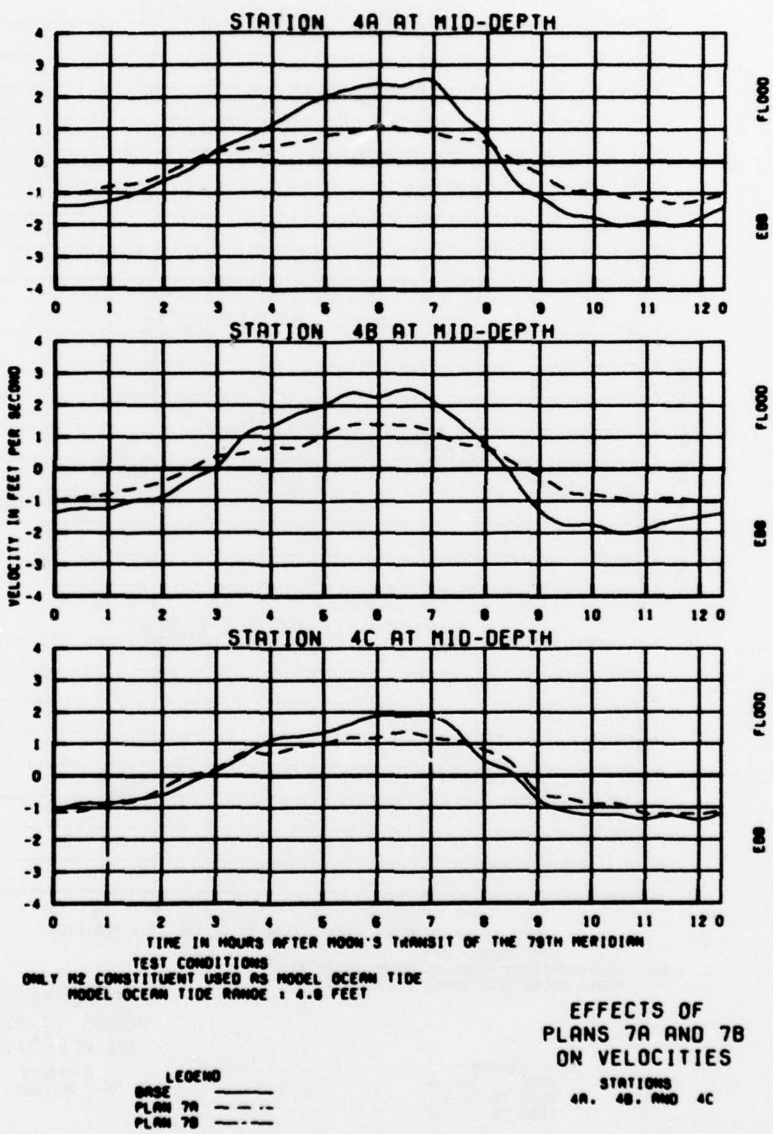
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

LEGEND
BASE
PLAN 7A
PLAN 7B

EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

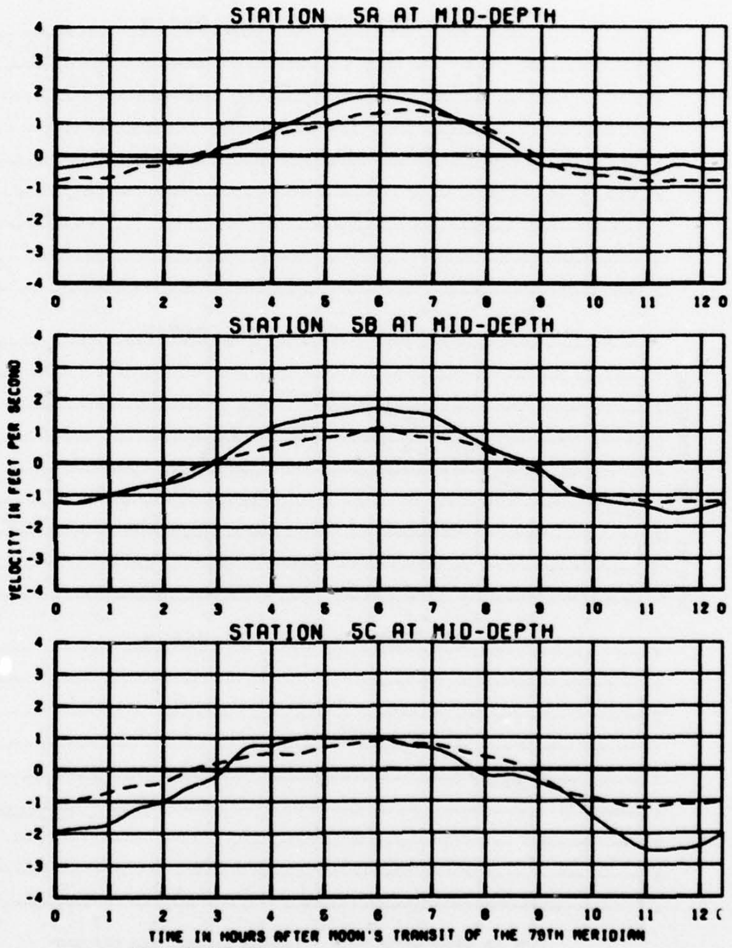
STATIONS
3C AND 3D

PLATE 100



EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

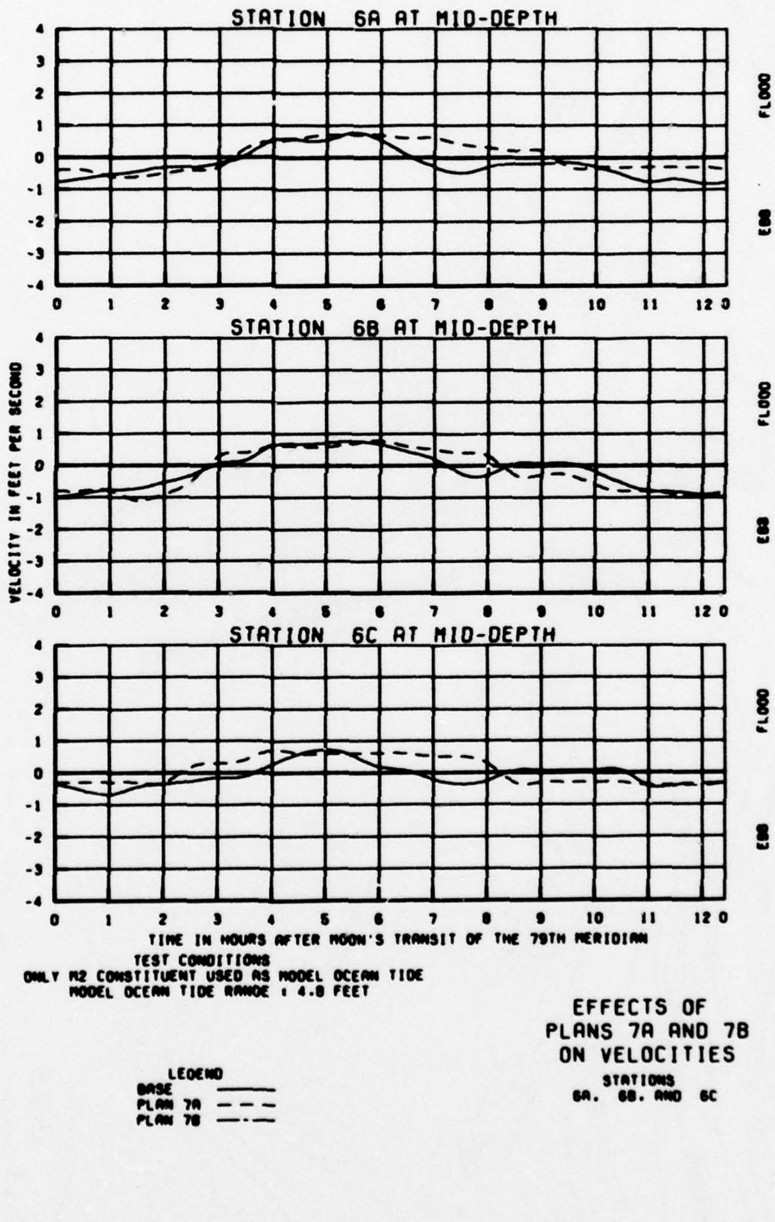
STATIONS
4A, 4B, AND 4C



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.0 FEET

EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES
STATIONS
5A, 5B, AND 5C

LEGEND
BASE
PLAN 7A
PLAN 7B



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE : 4.8 FEET

EFFECTS OF
PLANS 7A AND 7B
ON VELOCITIES

STATIONS
6A, 6B, AND 6C

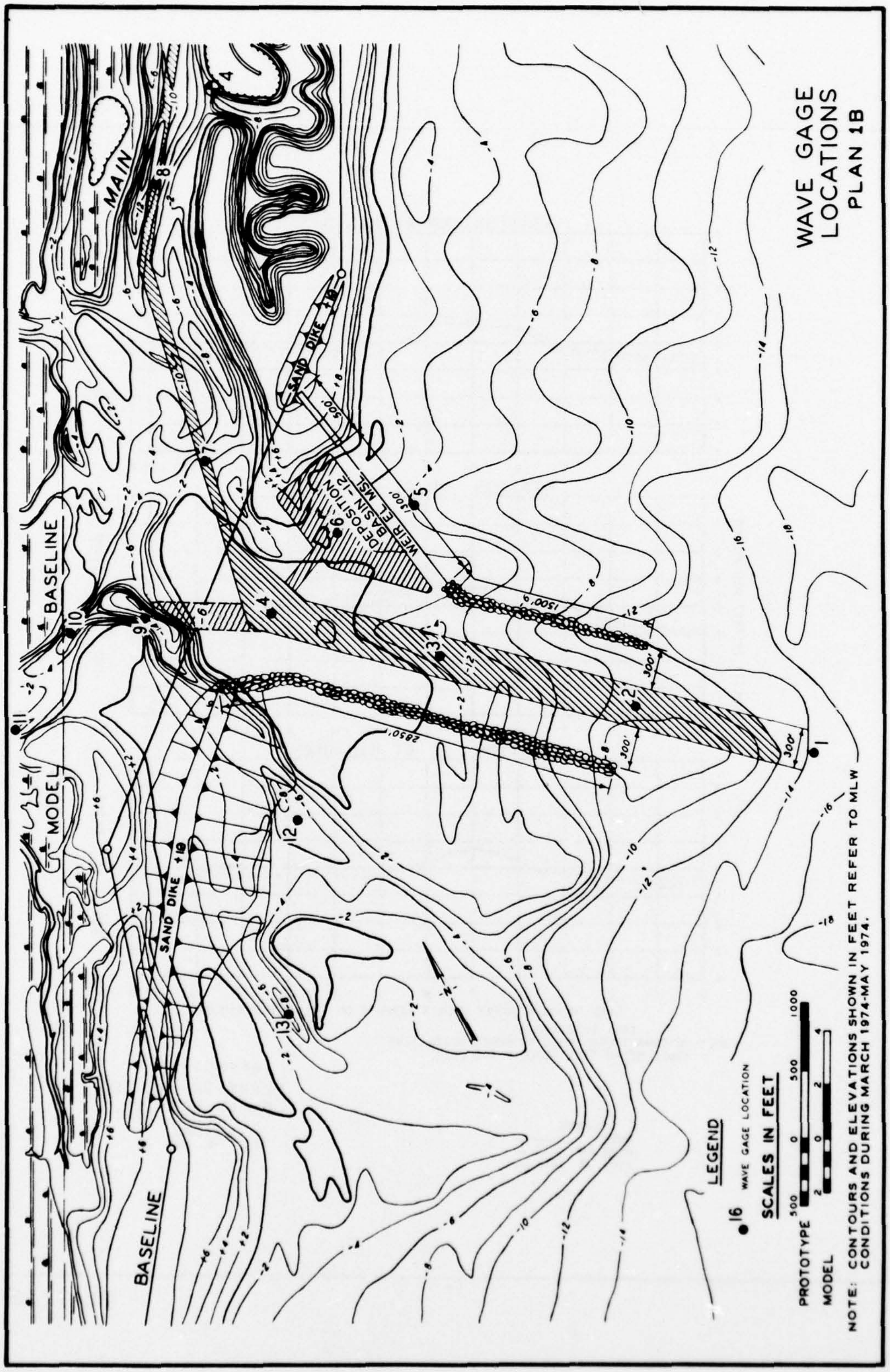
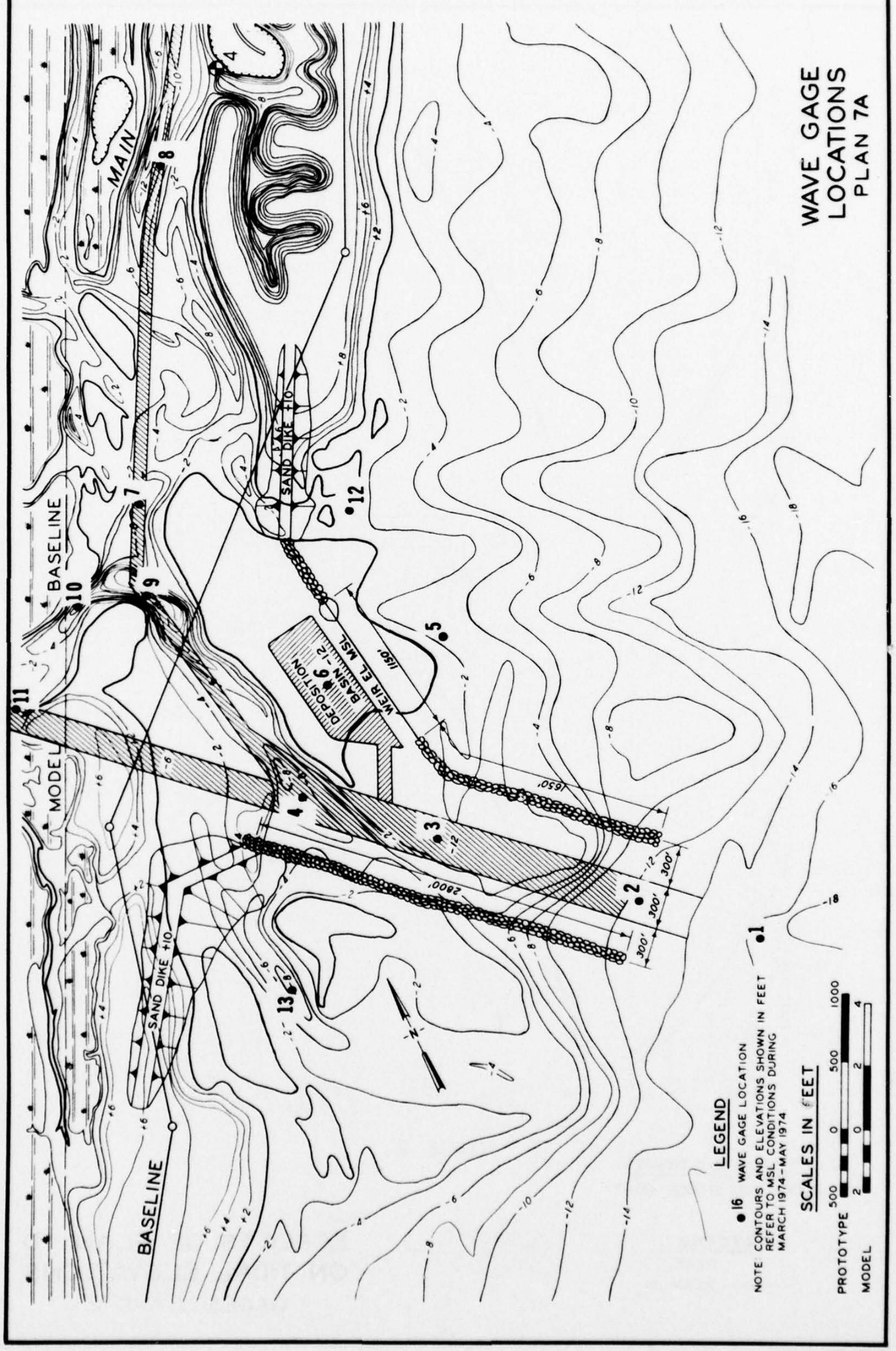
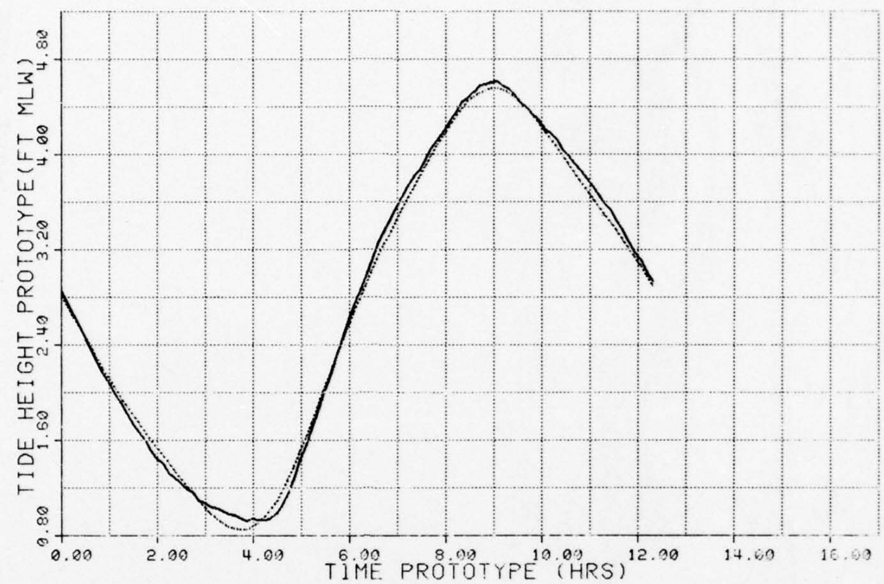
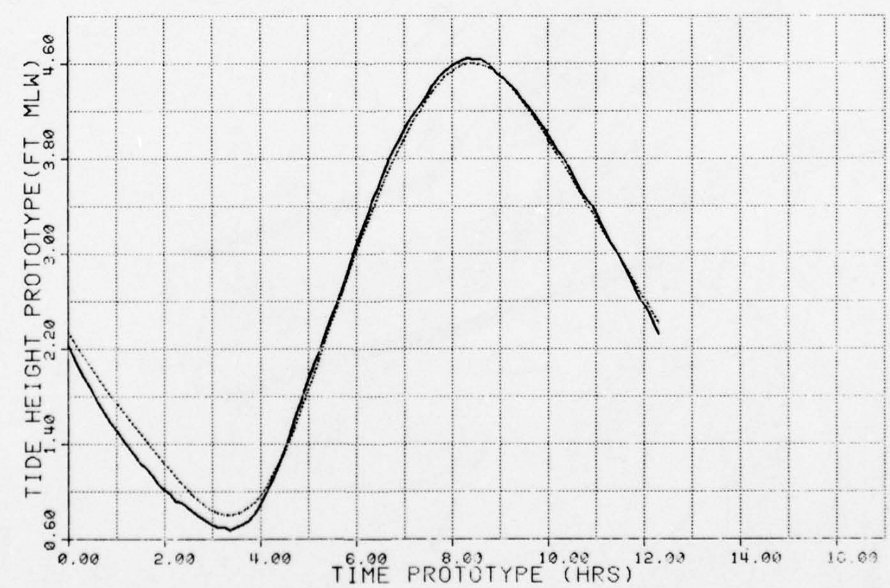

WAVE GAGE LOCATIONS
PLAN 1B
LEGEND
16 WAVE GAGE LOCATION
SCALES IN FEET
PROTOTYPE 500 0 500 1000
MODEL 2 0 2 4
NOTE: CONTOURS AND ELEVATIONS SHOWN IN FEET REFER TO MLW CONDITIONS DURING MARCH 1974-MAY 1974.
BASELINE
MODEL
MAIN
SAND DIKE +18
WEIR EL MSL
DEPOSITION BASIN -12
N

PLATE 104


WAVE GAGE LOCATIONS
PLAN 7A
LEGEND
16 WAVE GAGE LOCATION
NOTE CONTOURS AND ELEVATIONS SHOWN IN FEET REFER TO MSL CONDITIONS DURING MARCH 1974-MAY 1974
SCALES IN FEET
PROTOTYPE 500 0 500 1000
MODEL 2 0 2 4
BASELINE
MODEL
MAIN
SAND DIKE +10
SAND DIKE +10
DEPOSITION BASIN -12
WEIR EL MSL
1150'
1650'
2800'
300'
300'
300'
N



GAGE 1



GAGE 2

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

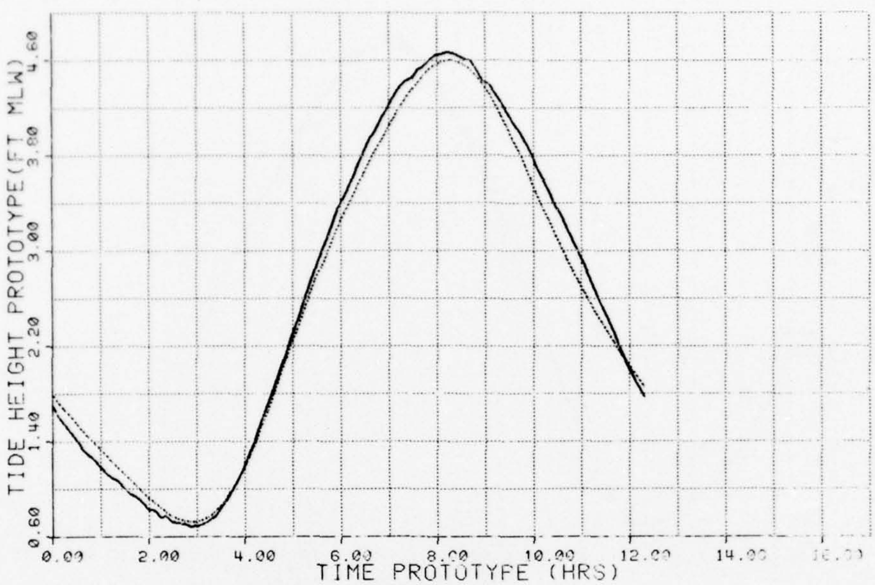
LEGEND

.... BASE

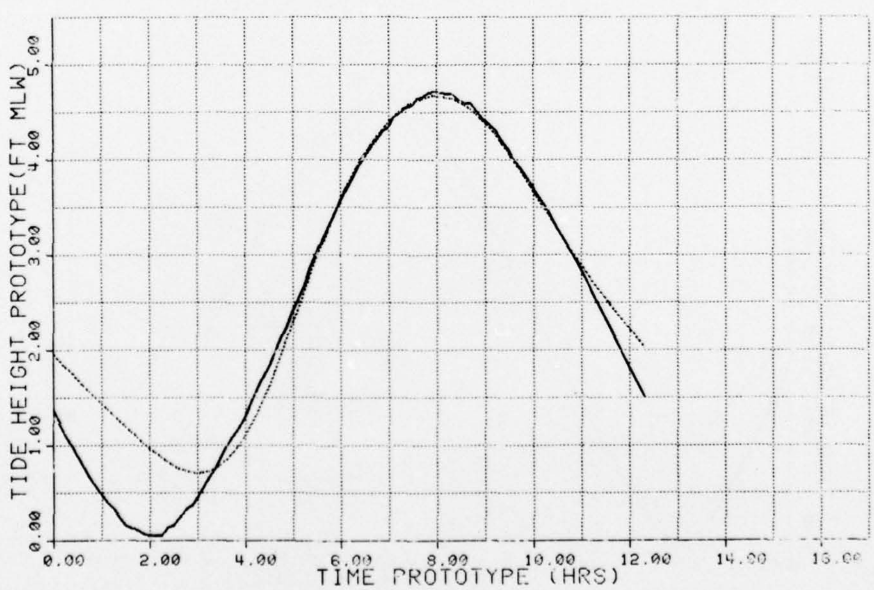
——— PLAN 1D

EFFECTS OF PLAN 1D ON TIDAL ELEVATIONS

GAGES 1 AND 2



GAGE 3



GAGE 4

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

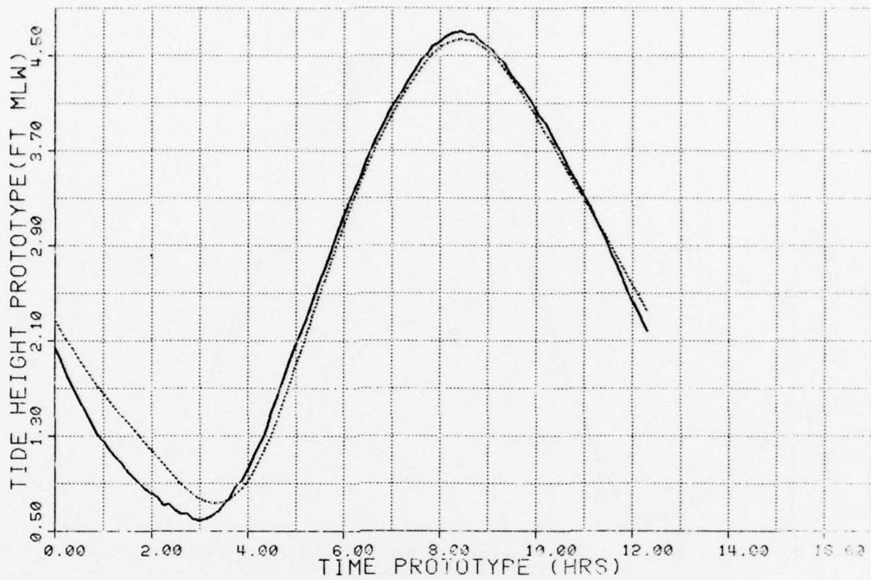
LEGEND

.... BASE

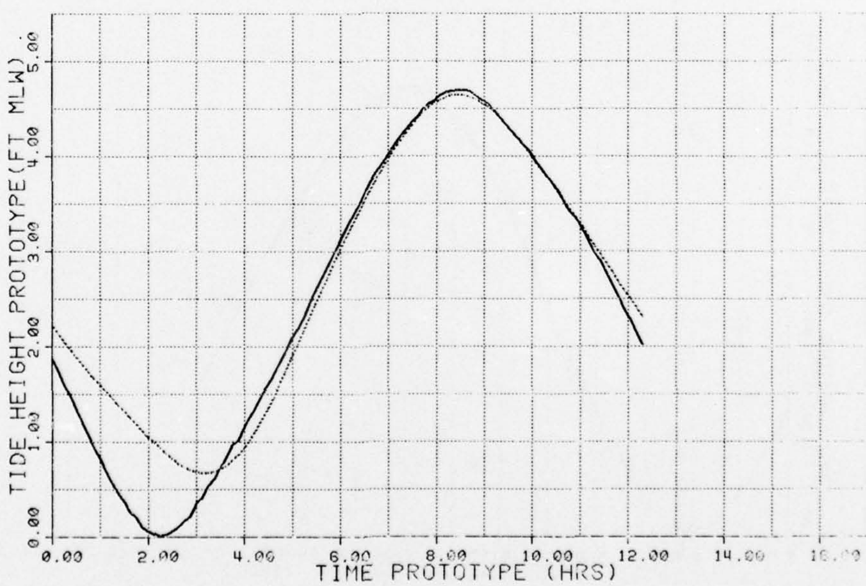
——— PLAN 1D

EFFECTS OF PLAN 1D ON TIDAL ELEVATIONS

GAGES 3 AND 4



GAGE 5



GAGE 6

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

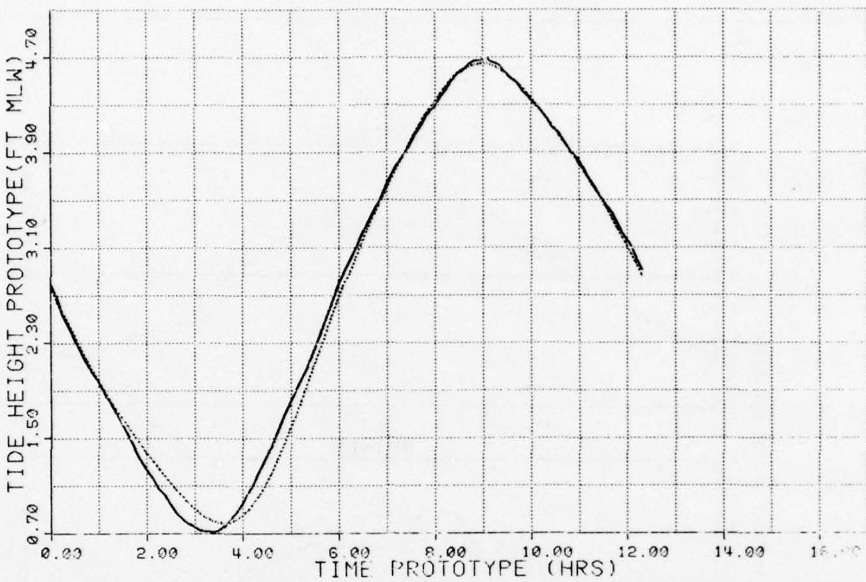
LEGEND

.... BASE

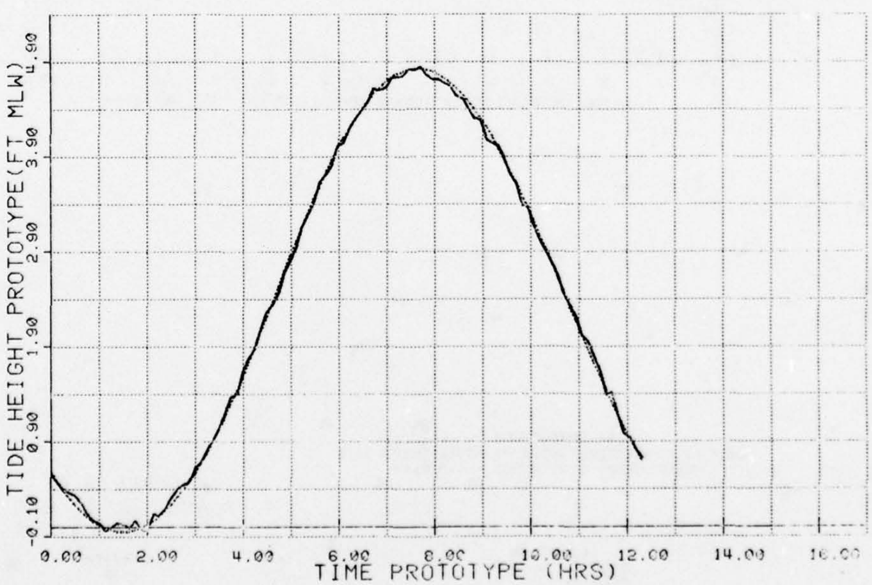
———— PLAN 1D

EFFECTS OF PLAN 1D ON TIDAL ELEVATIONS

GAGES 5 AND 6



GAGE 7



GAGE 8

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

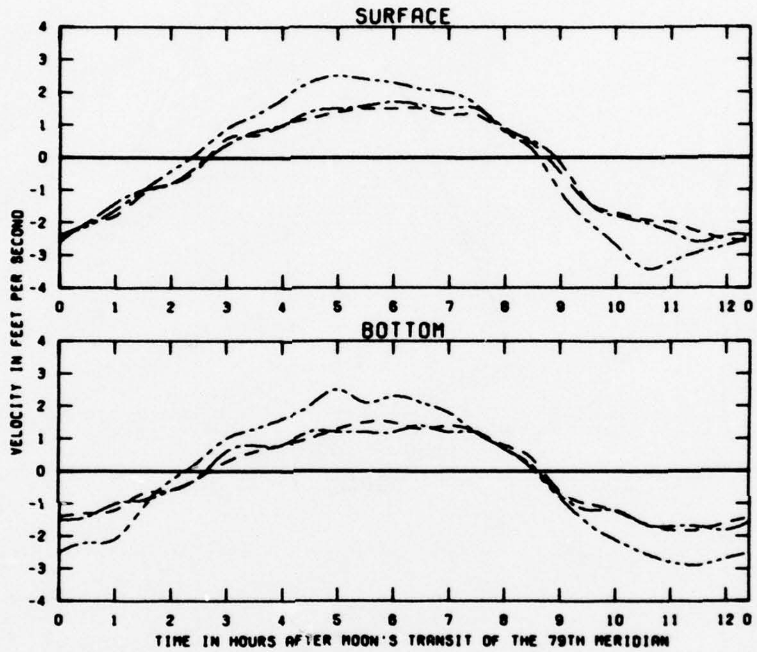
LEGEND

.... BASE

——— PLAN 1D

EFFECTS OF PLAN 1D ON TIDAL ELEVATIONS

GAGES 7 AND 8



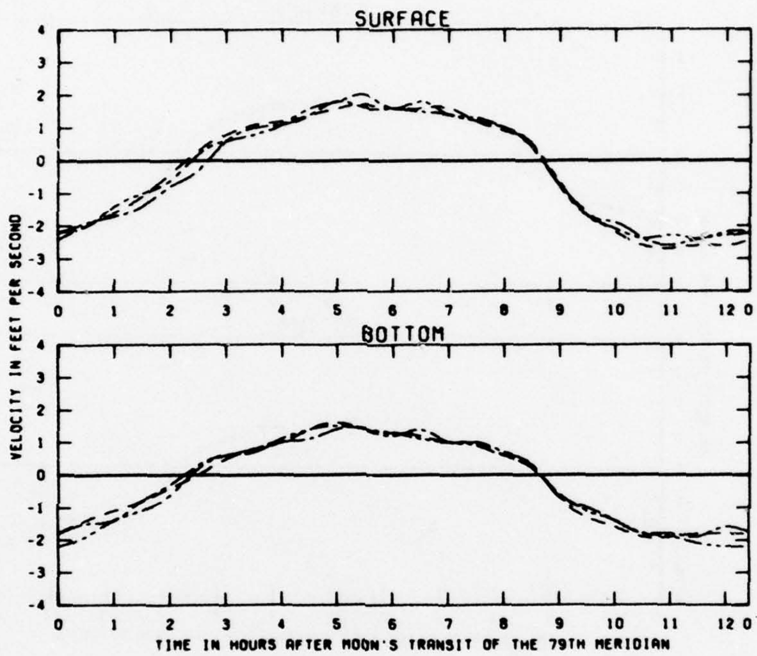
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE
PLAN 1B
PLAN 1C
PLAN 1D

EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES

STATION
7A

PLATE 110

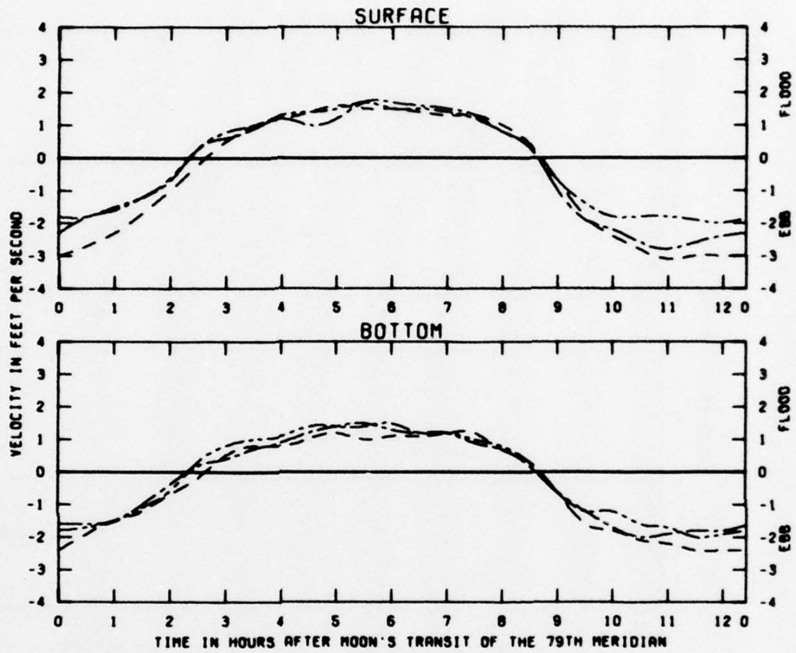


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE
PLAN 1B
PLAN 1C
PLAN 1D

EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES
STATION
8A

PLATE 111



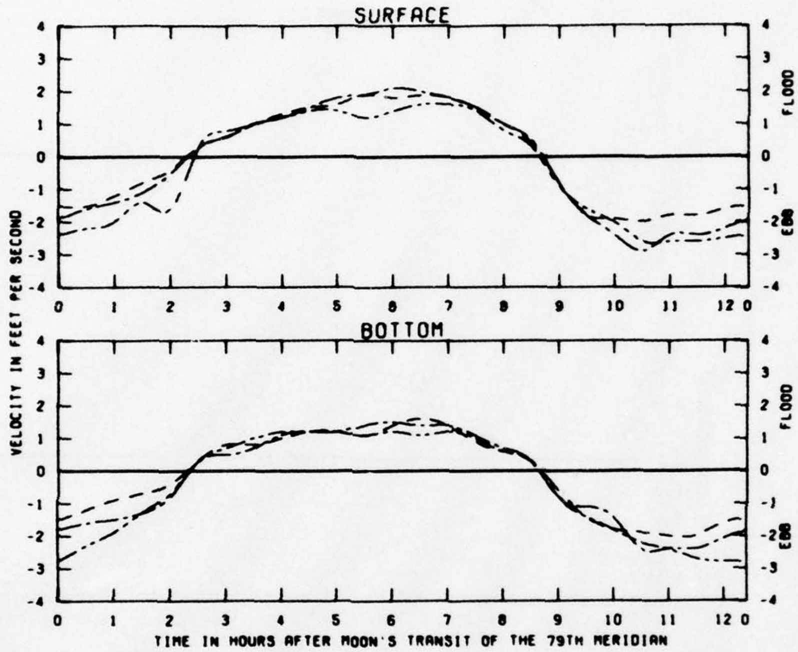
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1B — — —
PLAN 1C —·—
PLAN 1D —··—

EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES

STATION
9A

PLATE 112



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE
PLAN 1B
PLAN 1C
PLAN 1D

EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES

STATION
98

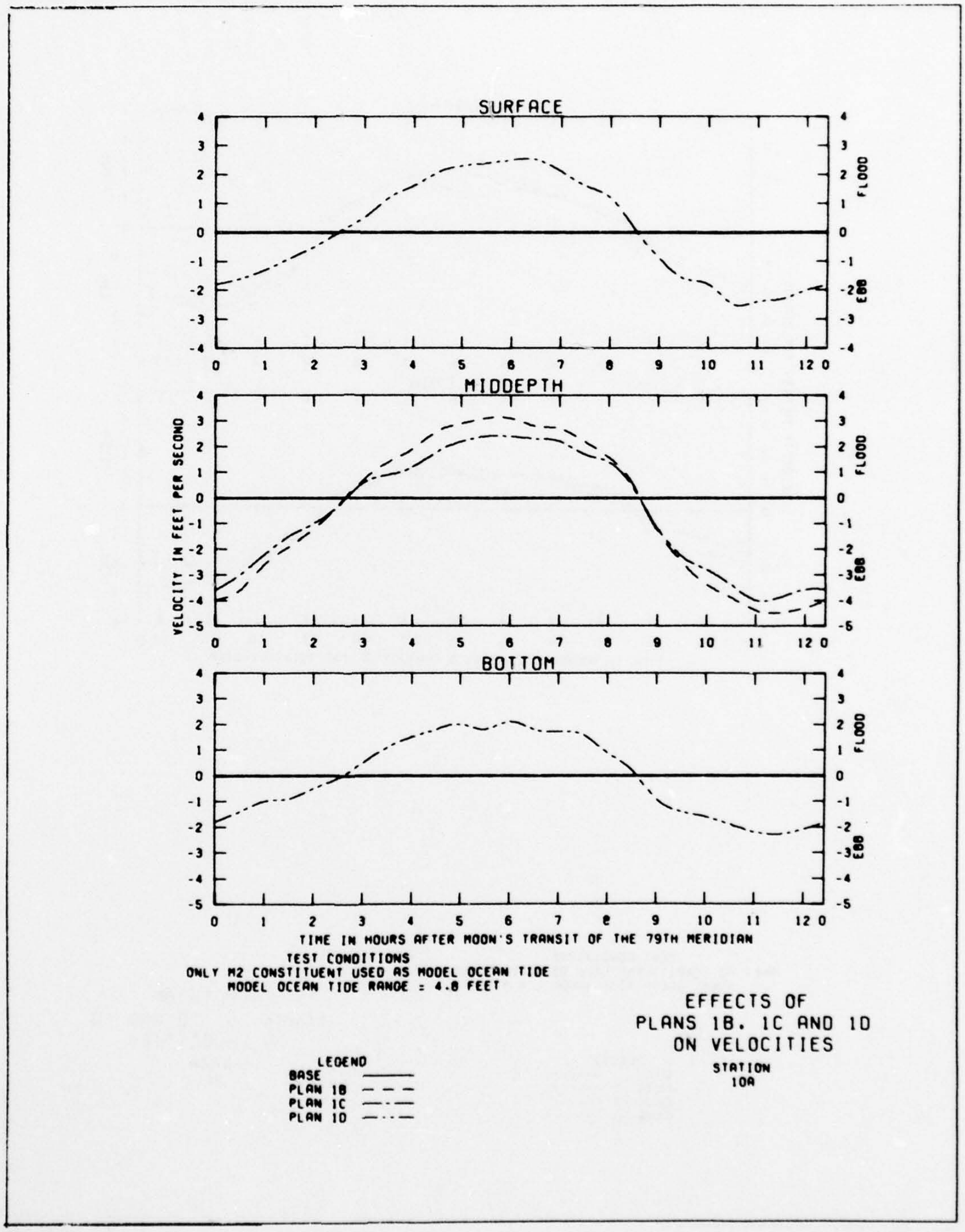
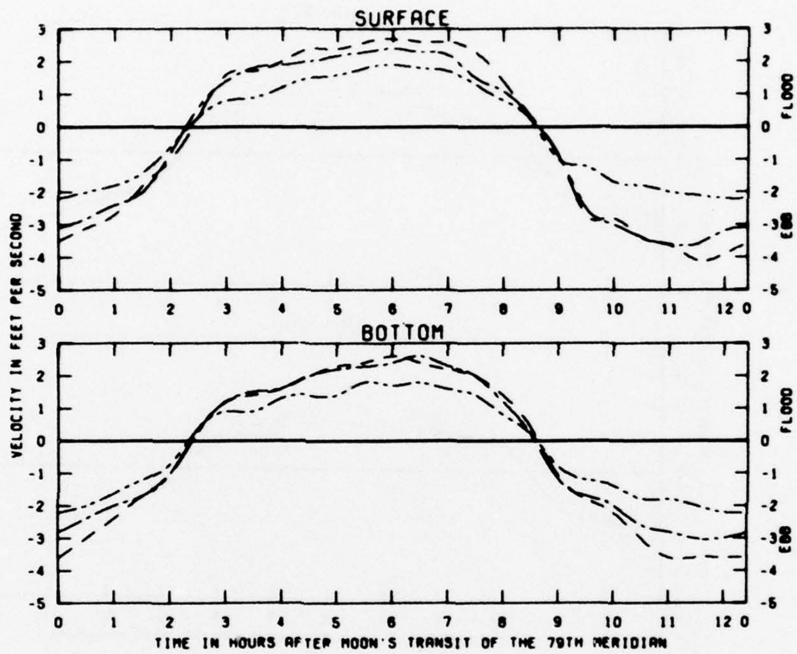

SURFACE
MIDDEPTH
BOTTOM
VELOCITY IN FEET PER SECOND
FLOOD
EBB
TIME IN HOURS AFTER MOON'S TRANSIT OF THE 79TH MERIDIAN
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET
EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES
STATION
10A
LEGEND
BASE
PLAN 1B
PLAN 1C
PLAN 1D

PLATE 114

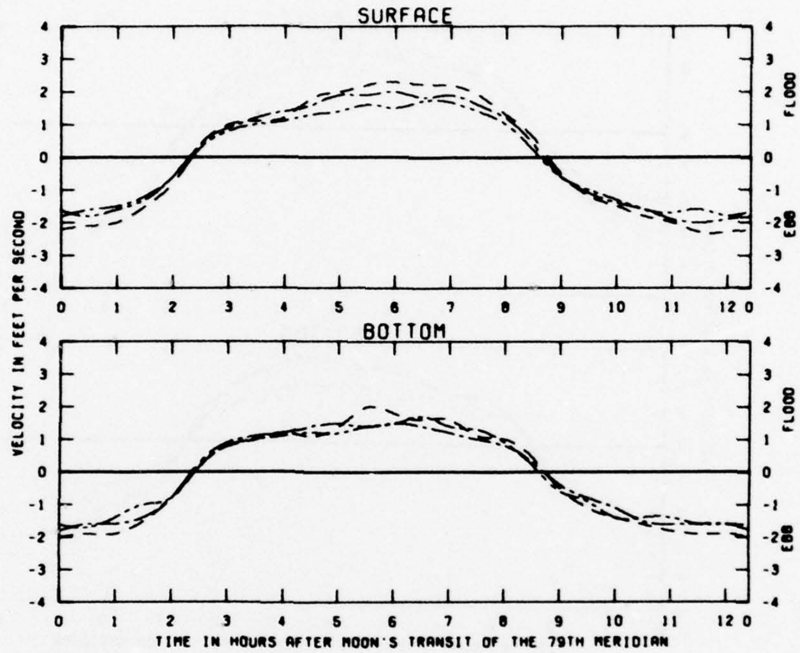


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE
PLAN 1B
PLAN 1C
PLAN 1D

EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES

STATION
11A



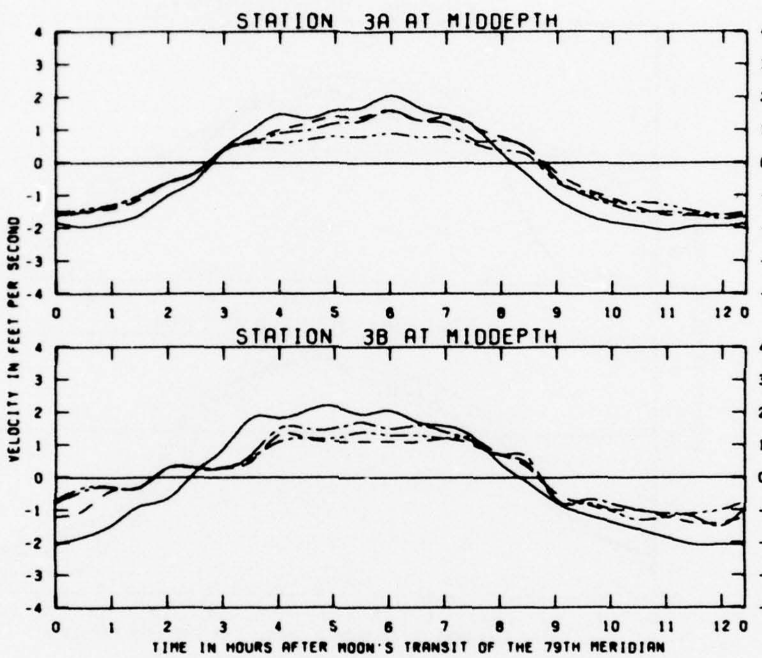
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE
PLAN 1B
PLAN 1C
PLAN 1D

EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES

STATION
12A

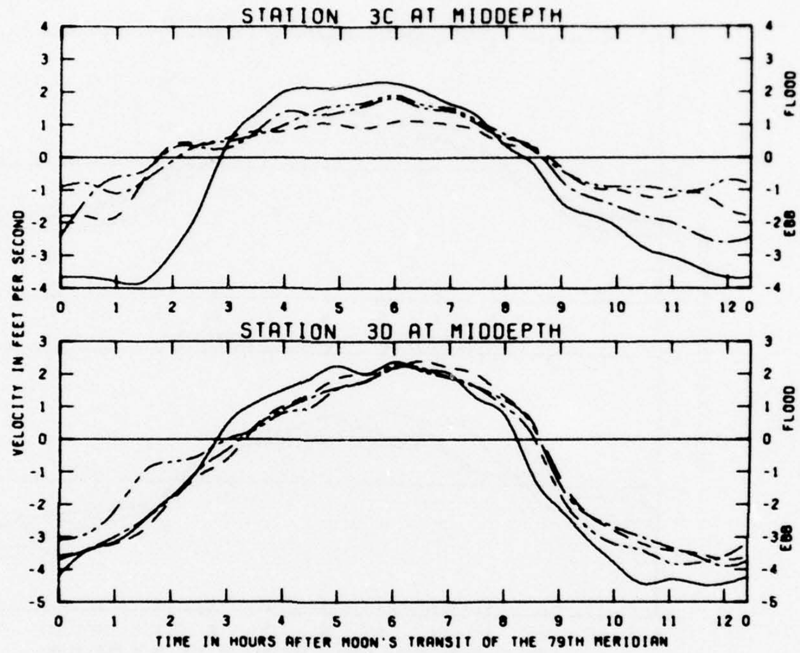
PLATE 116



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1B — — —
PLAN 1C —·—
PLAN 1D —··—

EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES
STATIONS
3A AND 3B

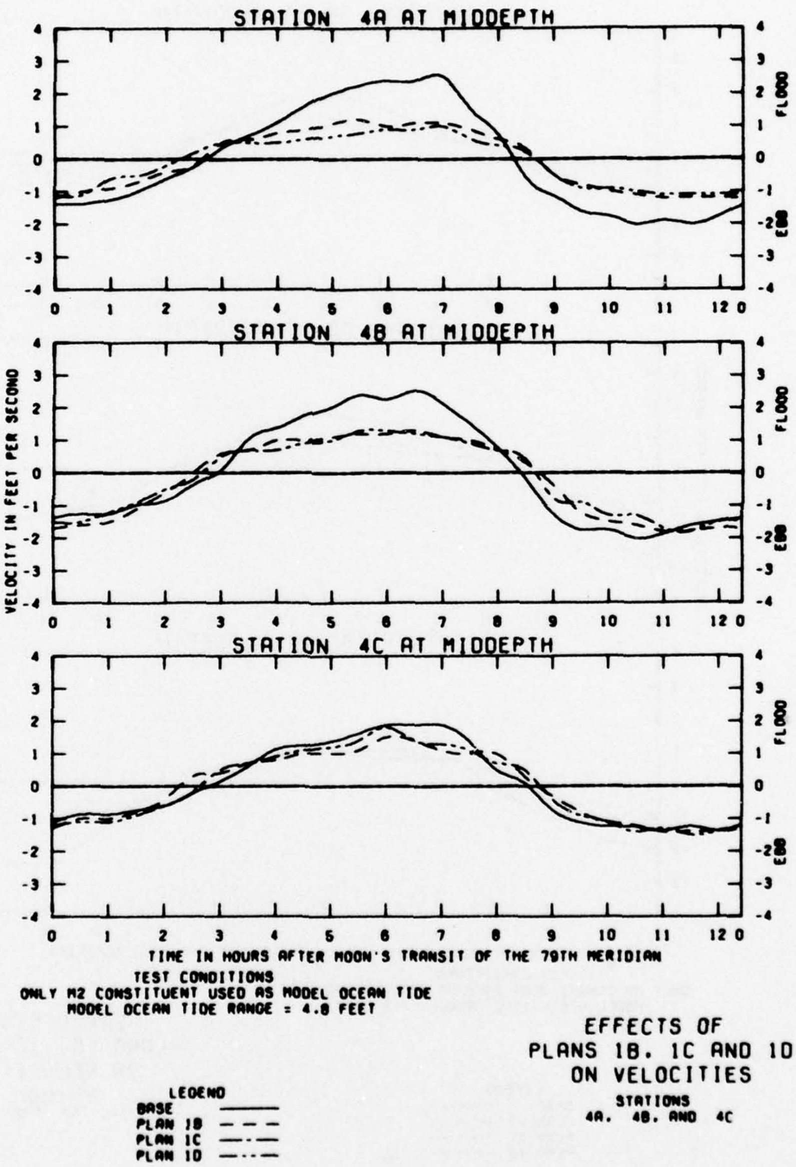


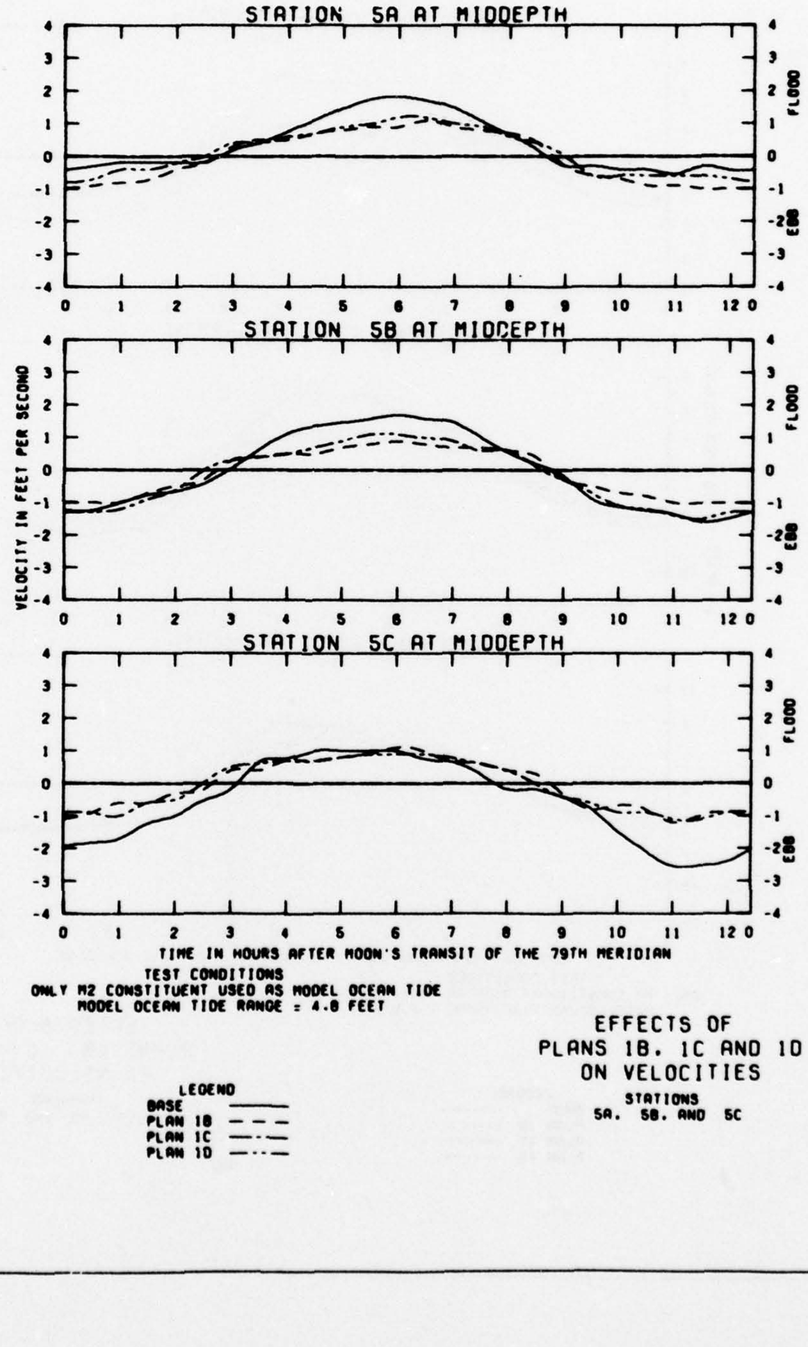
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE
PLAN 1B
PLAN 1C
PLAN 1D

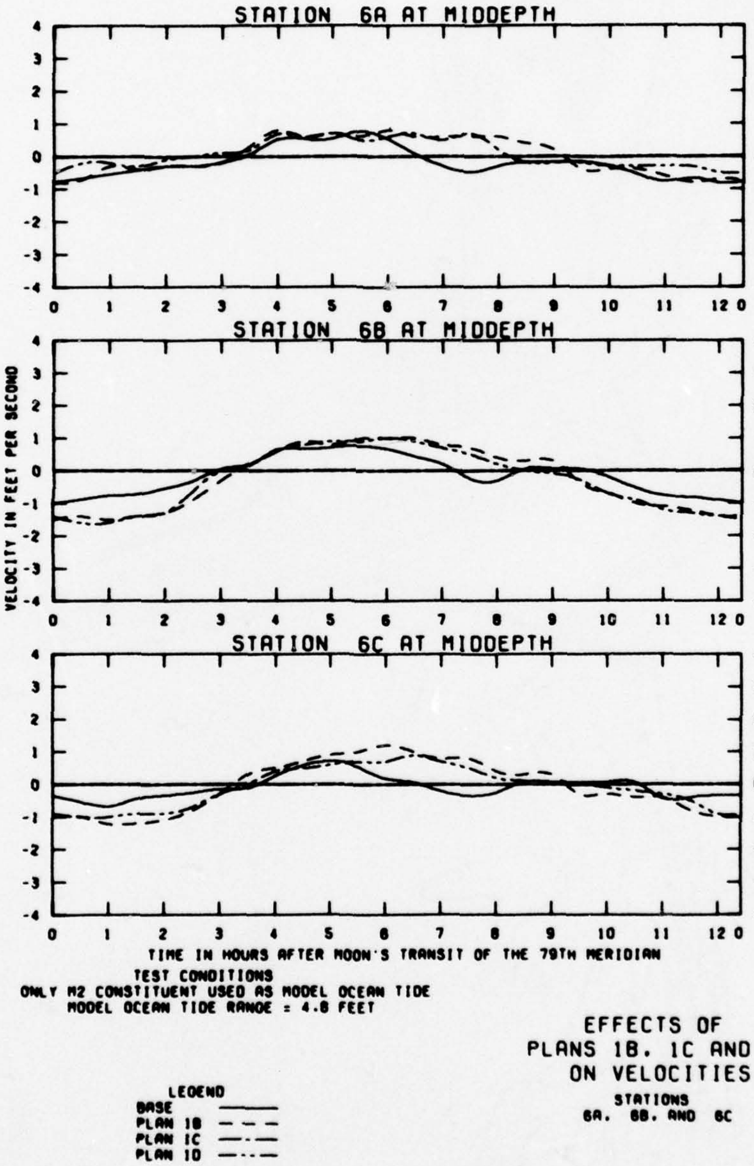
EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES

STATIONS
3C AND 3D


STATION 4A AT MIDDEPTH
STATION 4B AT MIDDEPTH
STATION 4C AT MIDDEPTH
VELOCITY IN FEET PER SECOND
FLOOD
EBB
TIME IN HOURS AFTER MOON'S TRANSIT OF THE 79TH MERIDIAN
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET
LEGEND
BASE
PLAN 1B
PLAN 1C
PLAN 1D
EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES
STATIONS
4A, 4B, AND 4C



EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES
STATIONS
5A, 5B, AND 5C



EFFECTS OF
PLANS 1B, 1C AND 1D
ON VELOCITIES

STATIONS
6A, 6B, AND 6C

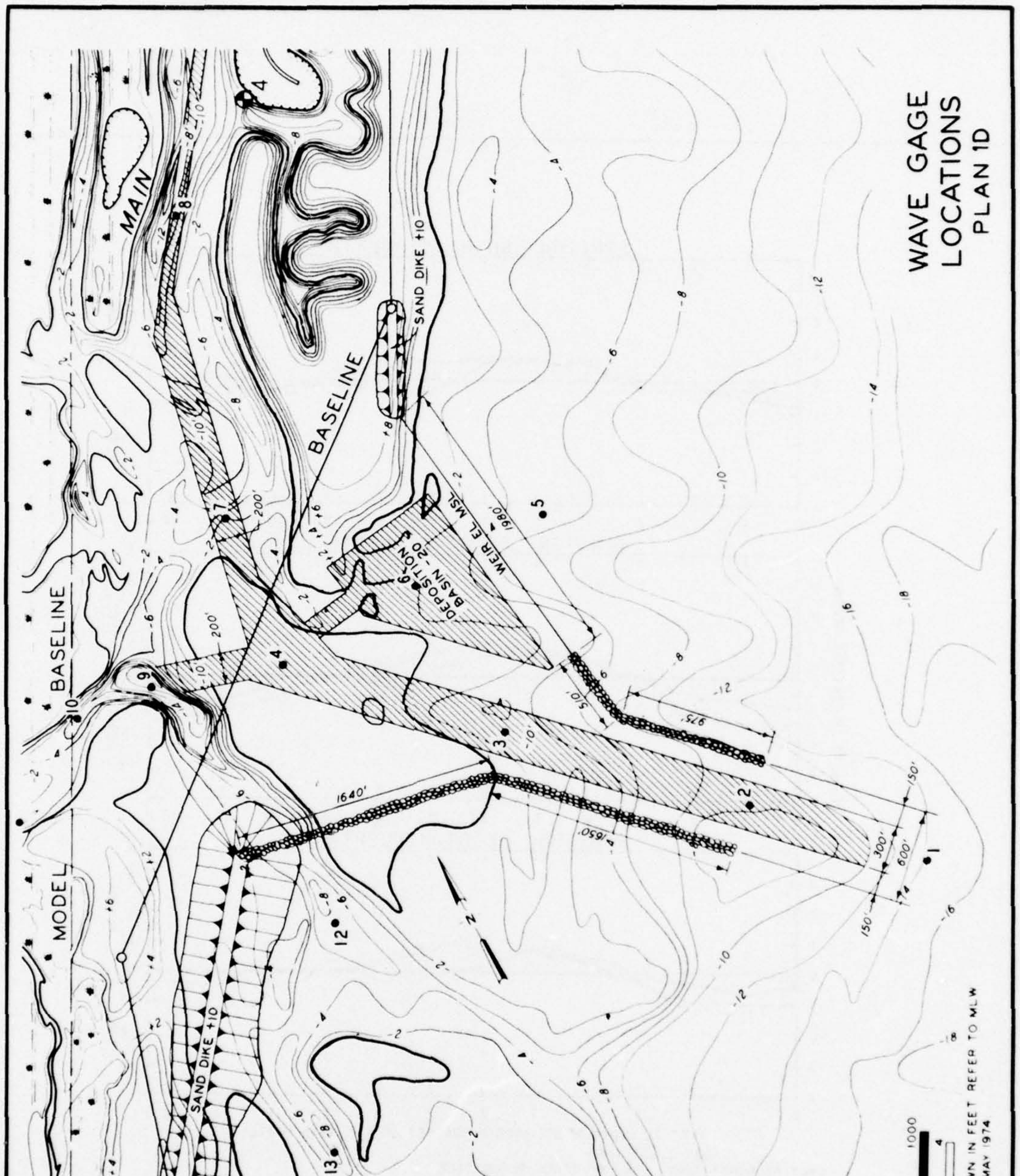
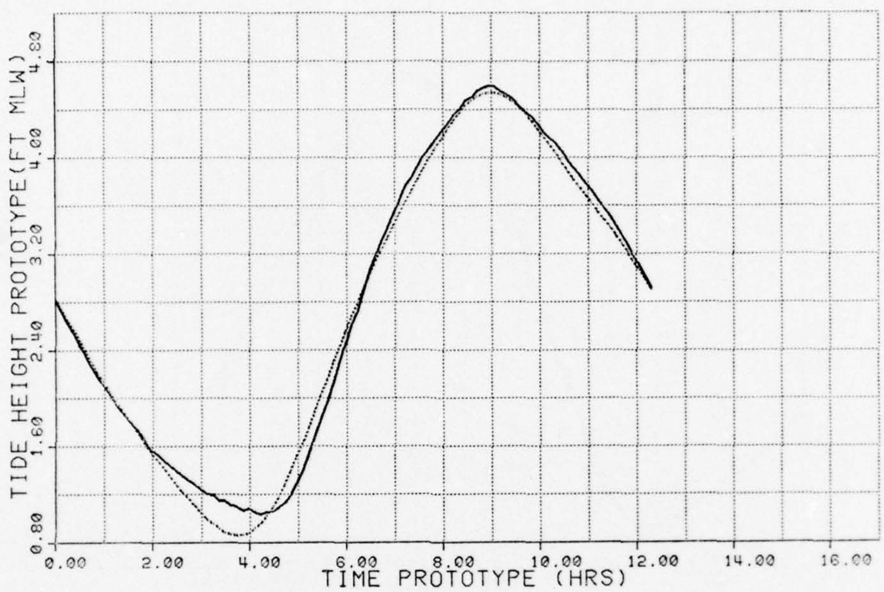
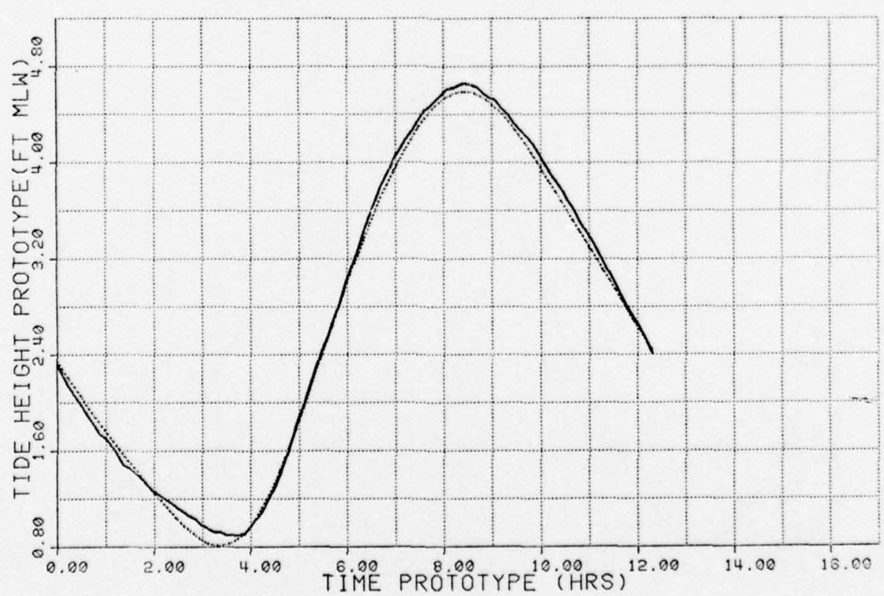

WAVE GAGE
LOCATIONS
PLAN 1D
LEGEND
•16 WAVE GAGE LOCATIONS
SCALE IN FEET
PROTOTYPE 500 0 500 1000
MODEL 2 0 2 4
NOTE: CONTOURS AND ELEVATIONS SHOWN IN FEET REFER TO MLW CONDITIONS DURING MARCH 1974 - MAY 1974
MODEL
BASELINE
MAIN
SAND DIKE +10
SAND DIKE +10
DEPOSITION BASIN -20
WEIR EL MSL
N

PLATE 122



GAGE 1



GAGE 2

TEST CONDITIONS

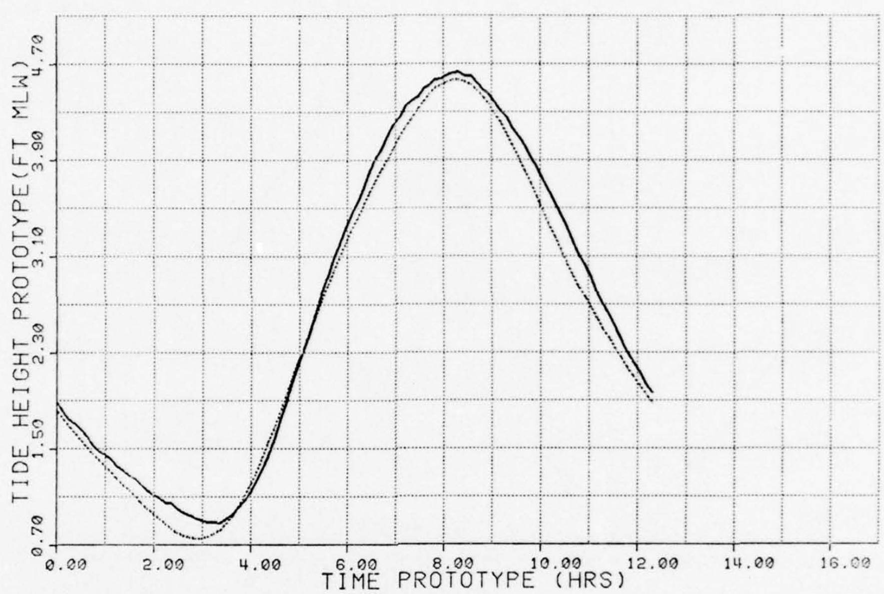
OCEAN TIDE RANGE 4.8 FT

LEGEND

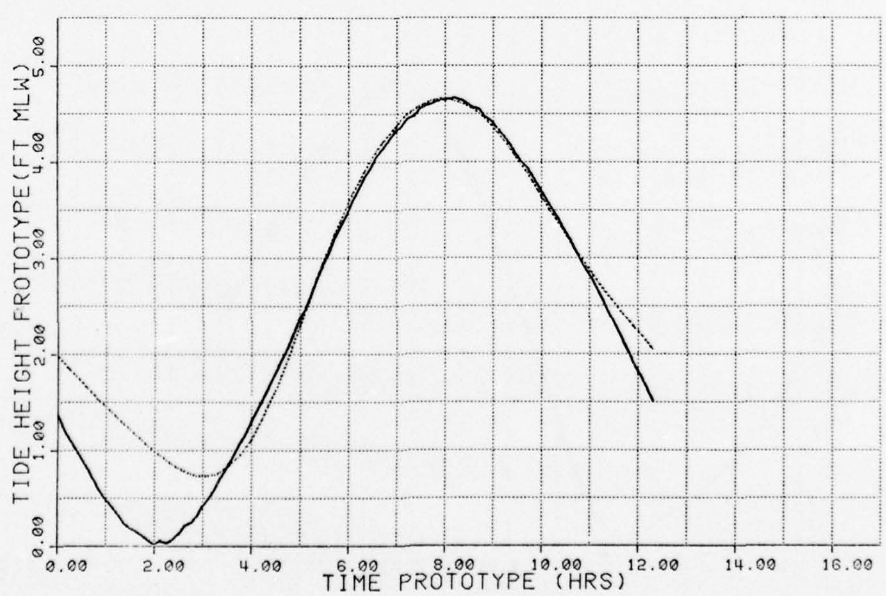
.... BASE
——— PLAN 1E

EFFECTS OF PLAN 1E ON TIDAL ELEVATIONS

GAGES 1 AND 2



GAGE 3



GAGE 4

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

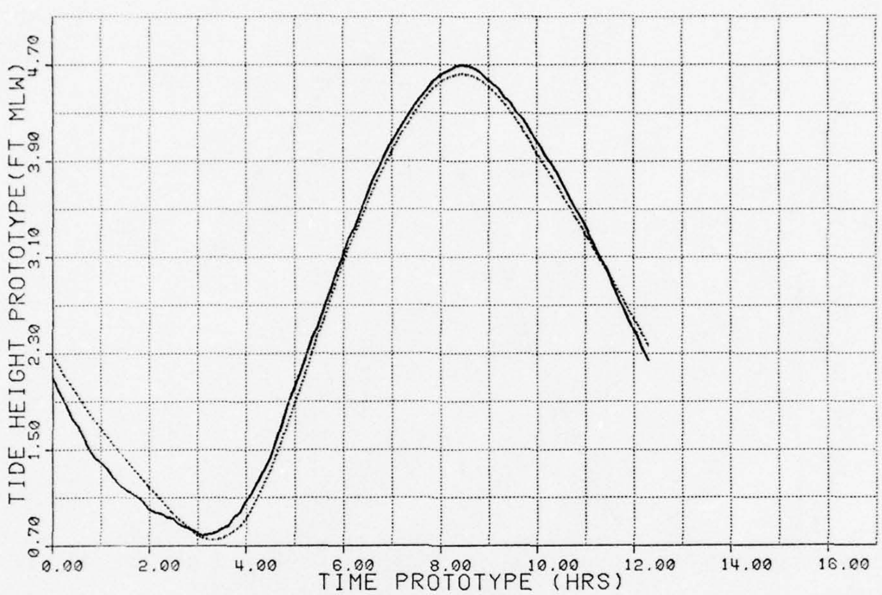
LEGEND

BASE

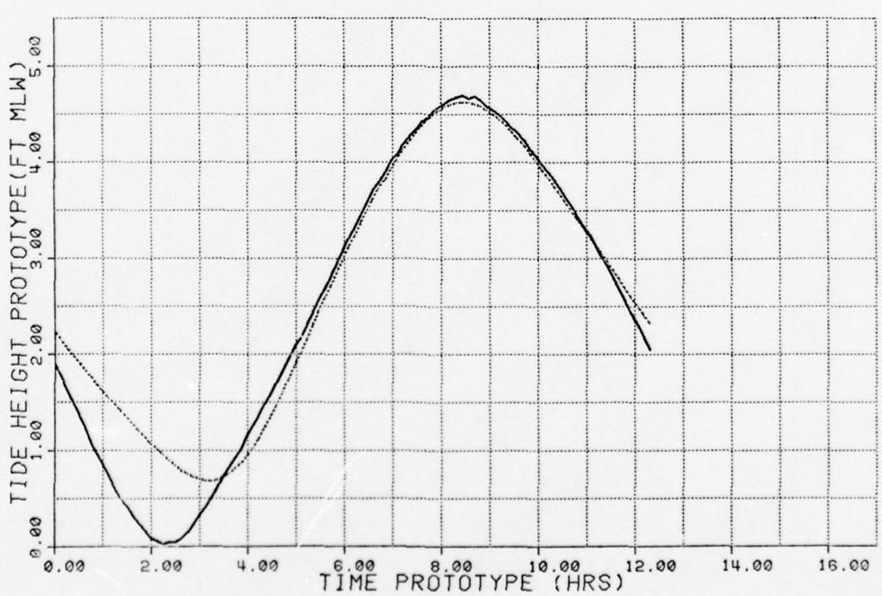
PLAN 1E

EFFECTS OF PLAN 1E ON TIDAL ELEVATIONS

GAGES 3 AND 4



GAGE 5



GAGE 6

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

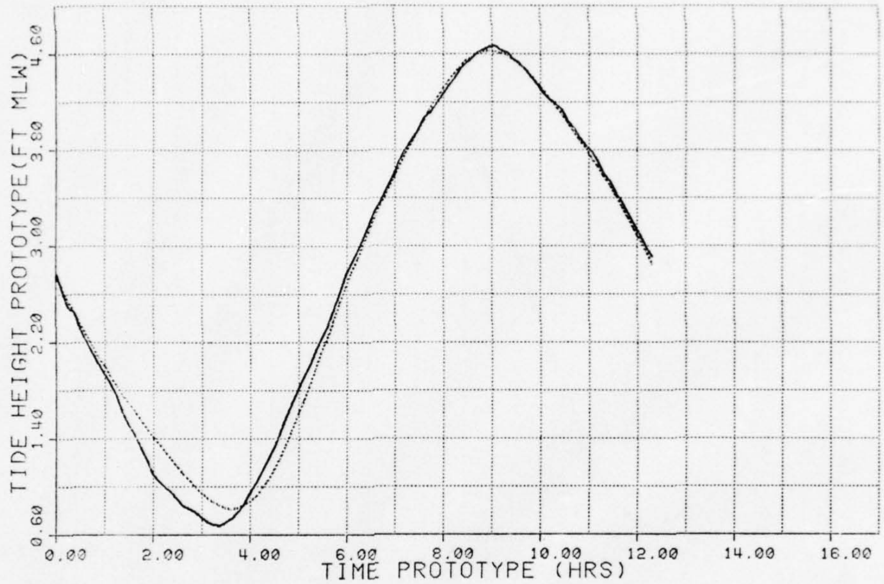
LEGEND

.... BASE

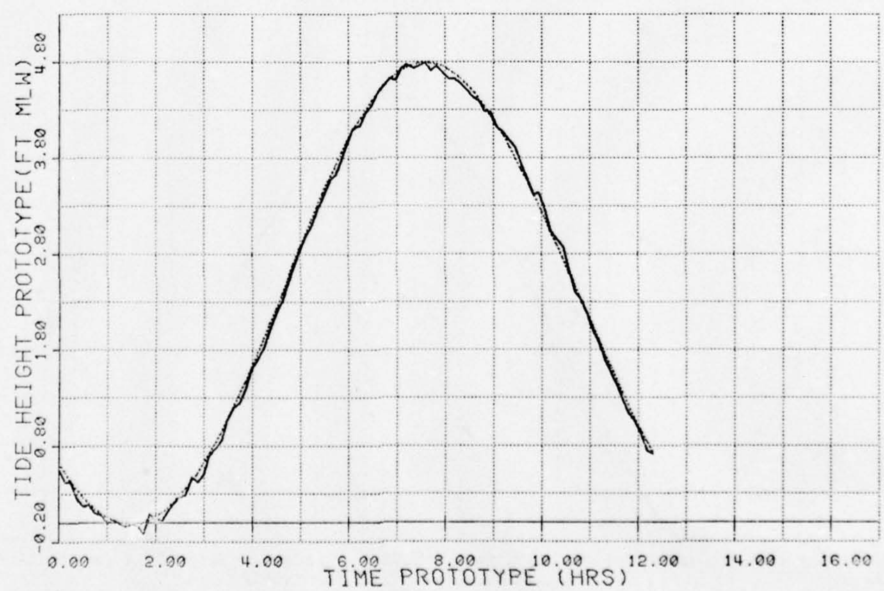
——— PLAN 1E

EFFECTS OF PLAN 1E ON TIDAL ELEVATIONS

GAGES 5 AND 6



GAGE 7



GAGE 8

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

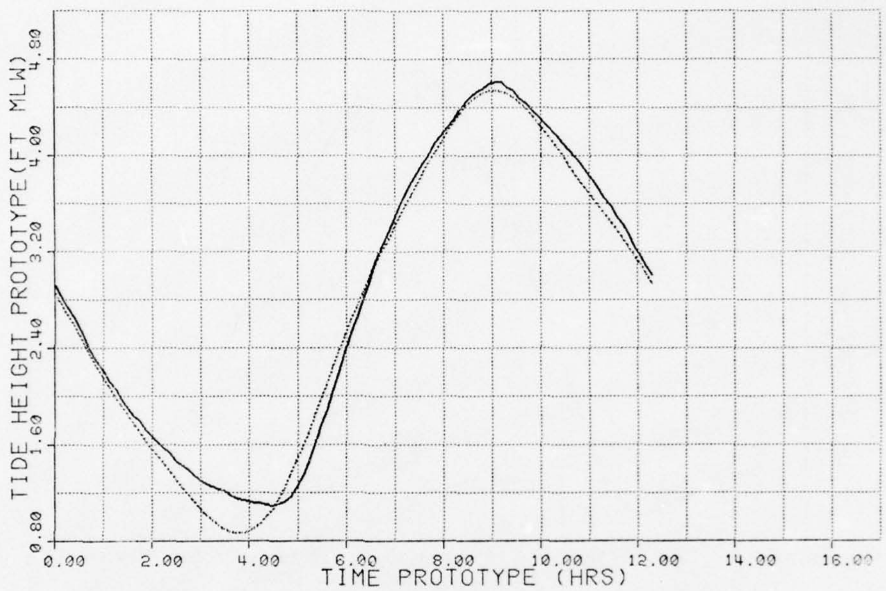
LEGEND

BASE

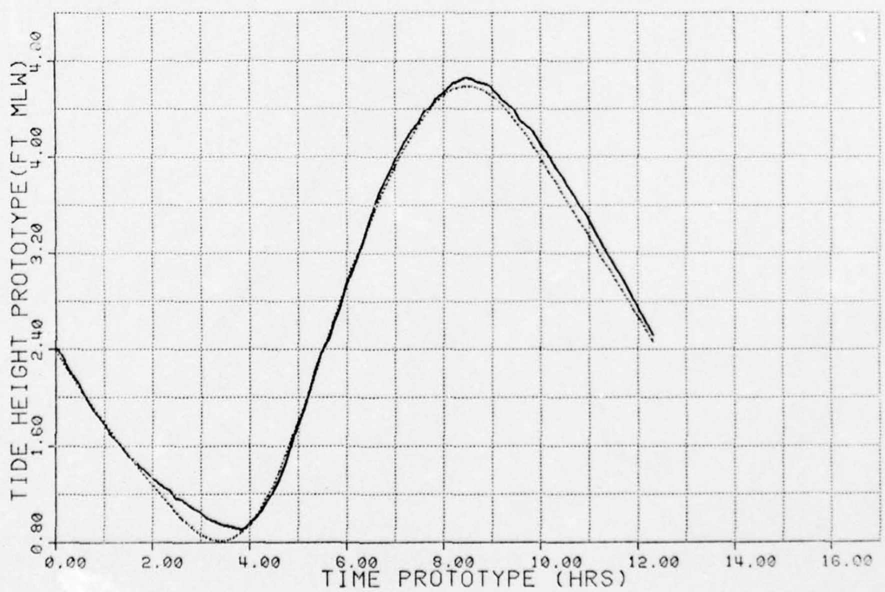
PLAN 1E

EFFECTS OF PLAN 1E ON TIDAL ELEVATIONS

GAGES 7 AND 8



GAGE 1



GAGE 2

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

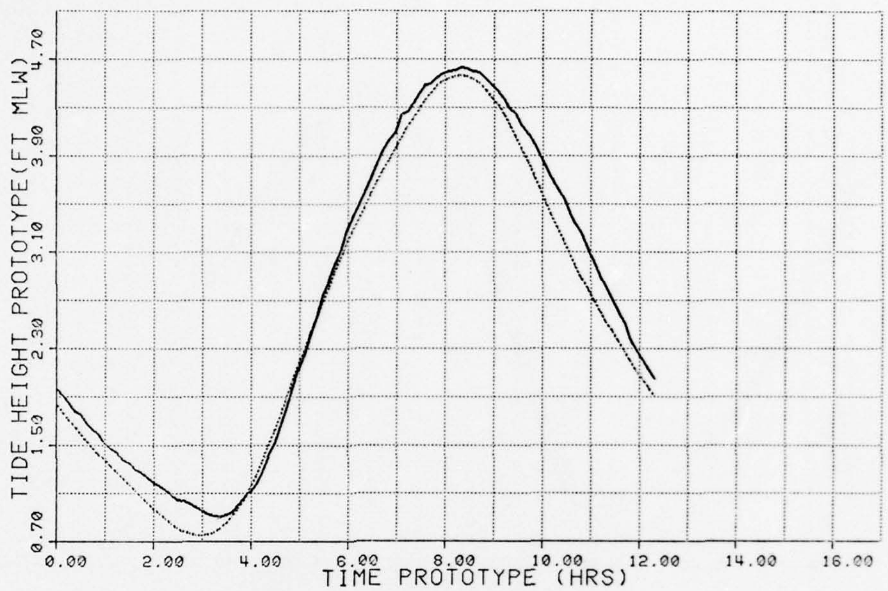
LEGEND

BASE

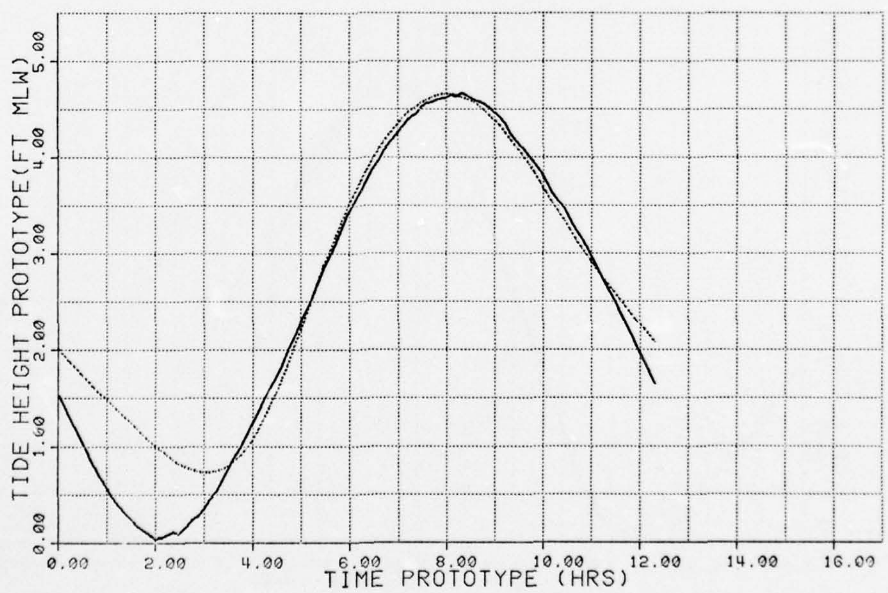
PLAN 1H

EFFECTS OF PLAN 1H ON TIDAL ELEVATIONS

GAGES 1 AND 2



GAGE 3



GAGE 4

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

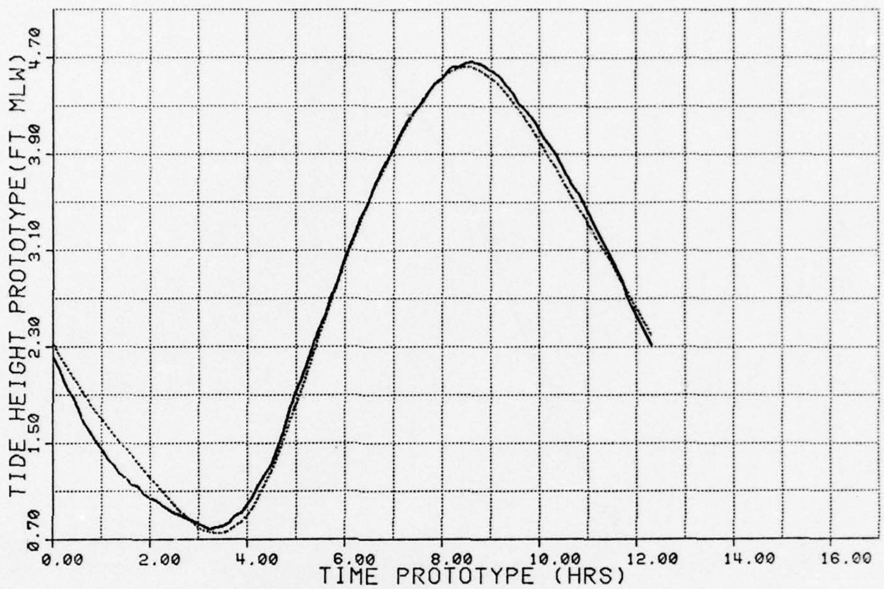
LEGEND

BASE

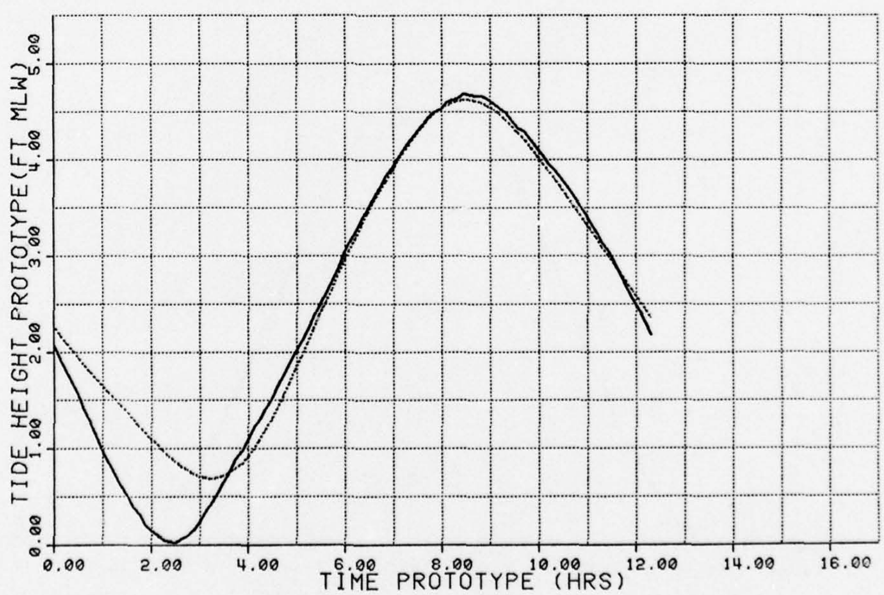
PLAN 1H

EFFECTS OF PLAN 1H ON TIDAL ELEVATIONS

GAGES 3 AND 4



GAGE 5



GAGE 6

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

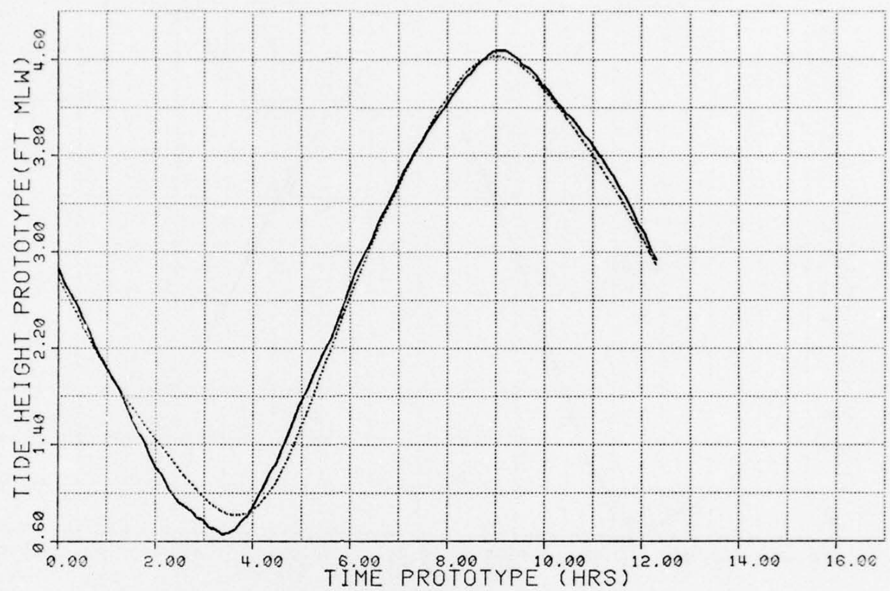
LEGEND

.... BASE

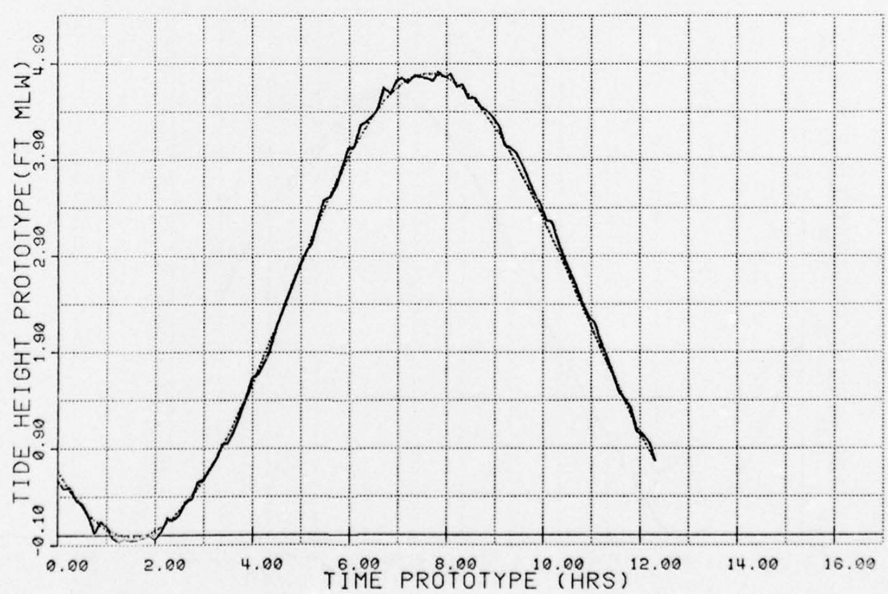
——— PLAN 1H

EFFECTS OF PLAN 1H ON TIDAL ELEVATIONS

GAGES 5 AND 6



GAGE 7



GAGE 8

TEST CONDITIONS

OCEAN TIDE RANGE 4.8 FT

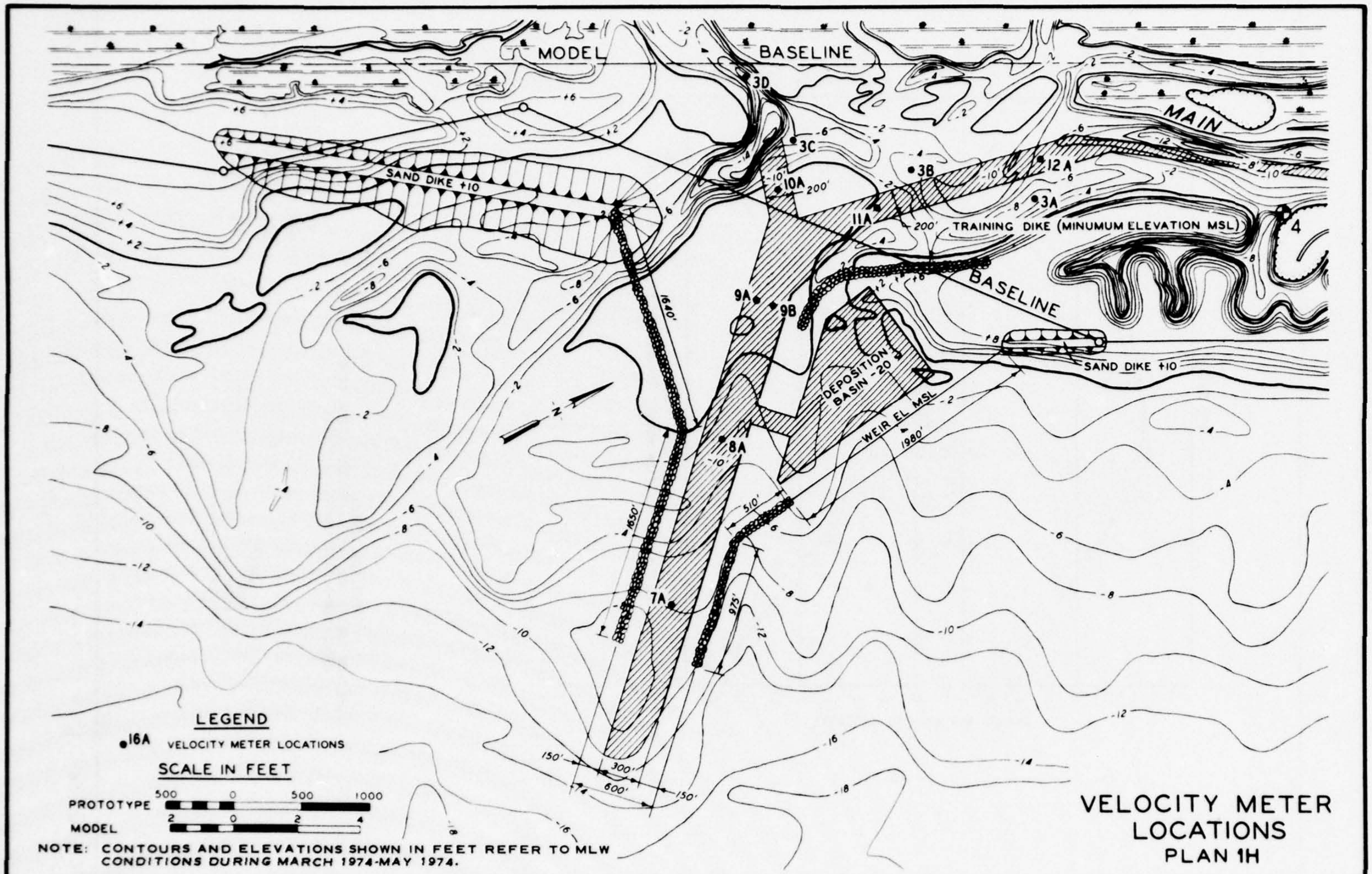
LEGEND

.... BASE

——— PLAN 1H

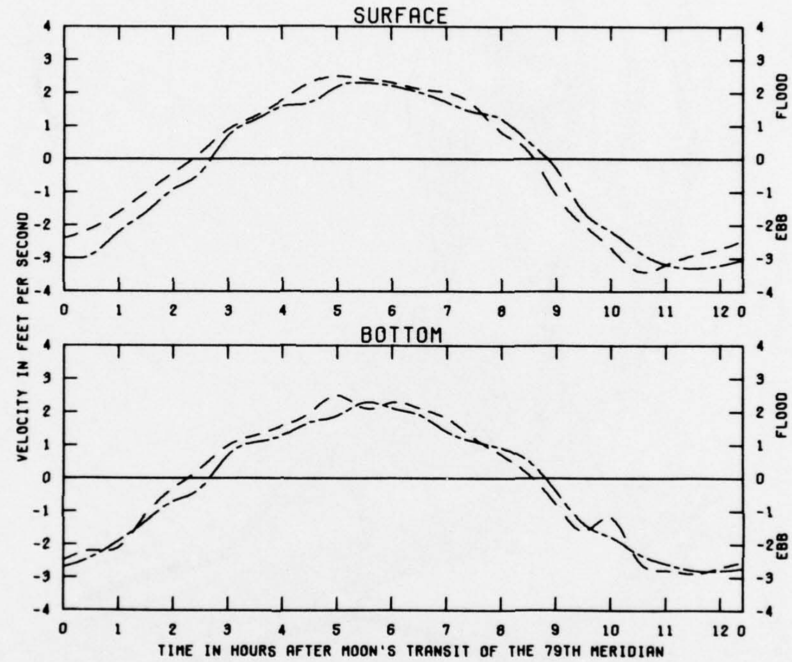
EFFECTS OF PLAN 1H ON TIDAL ELEVATIONS

GAGES 7 AND 8



NOTE: CONTOURS AND ELEVATIONS SHOWN IN FEET REFER TO MLW CONDITIONS DURING MARCH 1974-MAY 1974.

VELOCITY METER LOCATIONS
PLAN 1H



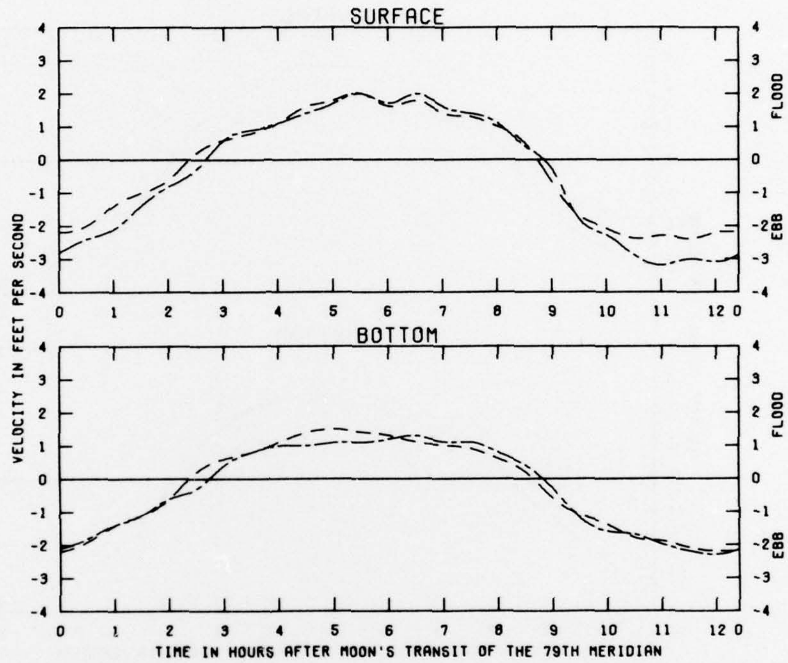
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE
PLAN 1D
PLAN 1H

EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES

STATION
7A

PLATE 132

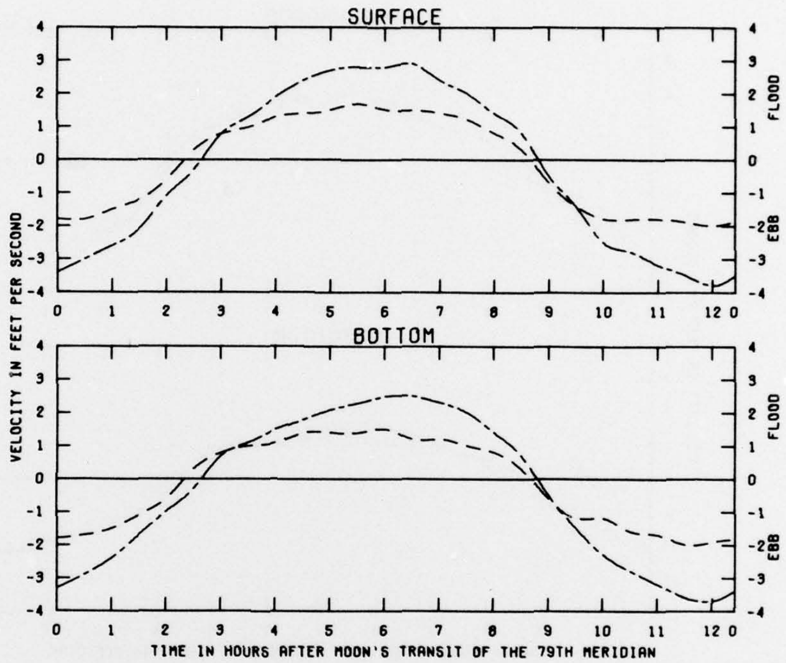


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES

STATION
8A

LEGEND
BASE
PLAN 1D
PLAN 1H

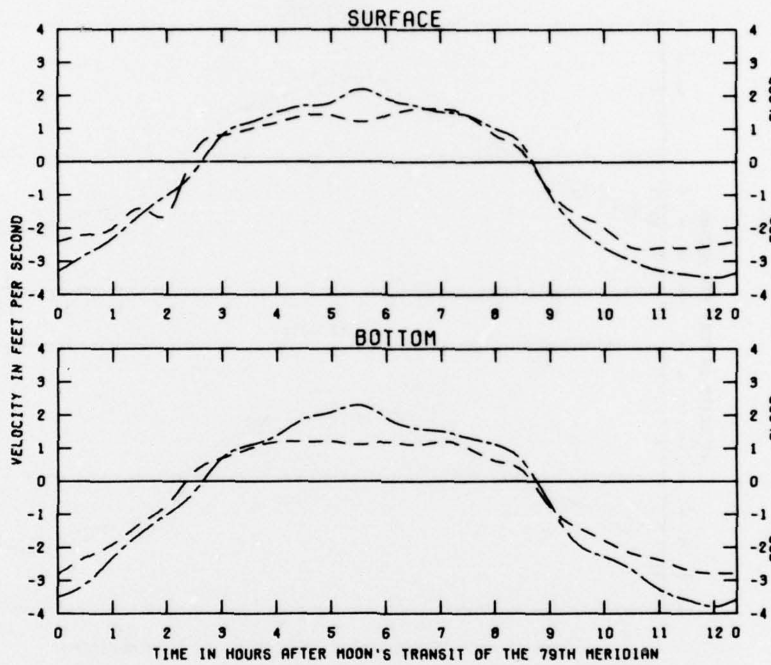


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES

STATION
9A

LEGEND
BASE ———
PLAN 1D — — —
PLAN 1H —·—·—



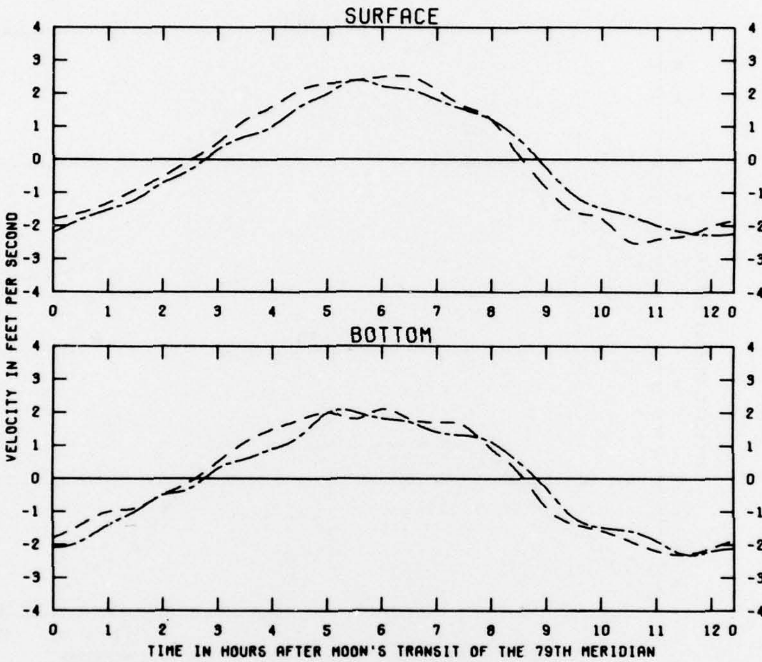
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE
PLAN 1D
PLAN 1H

EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES

STATION
9B

PLATE 135

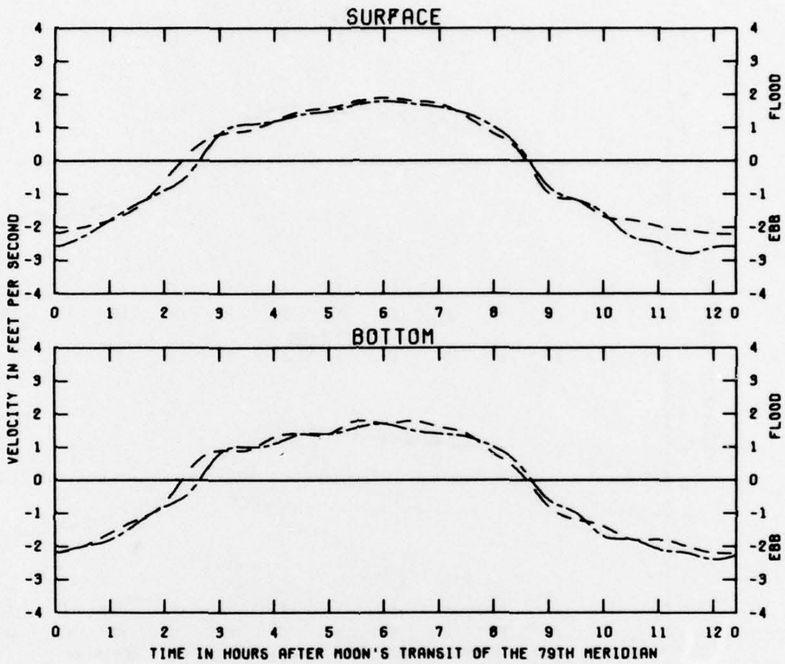


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1D — — —
PLAN 1H —·—·—

EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES

STATION
10A

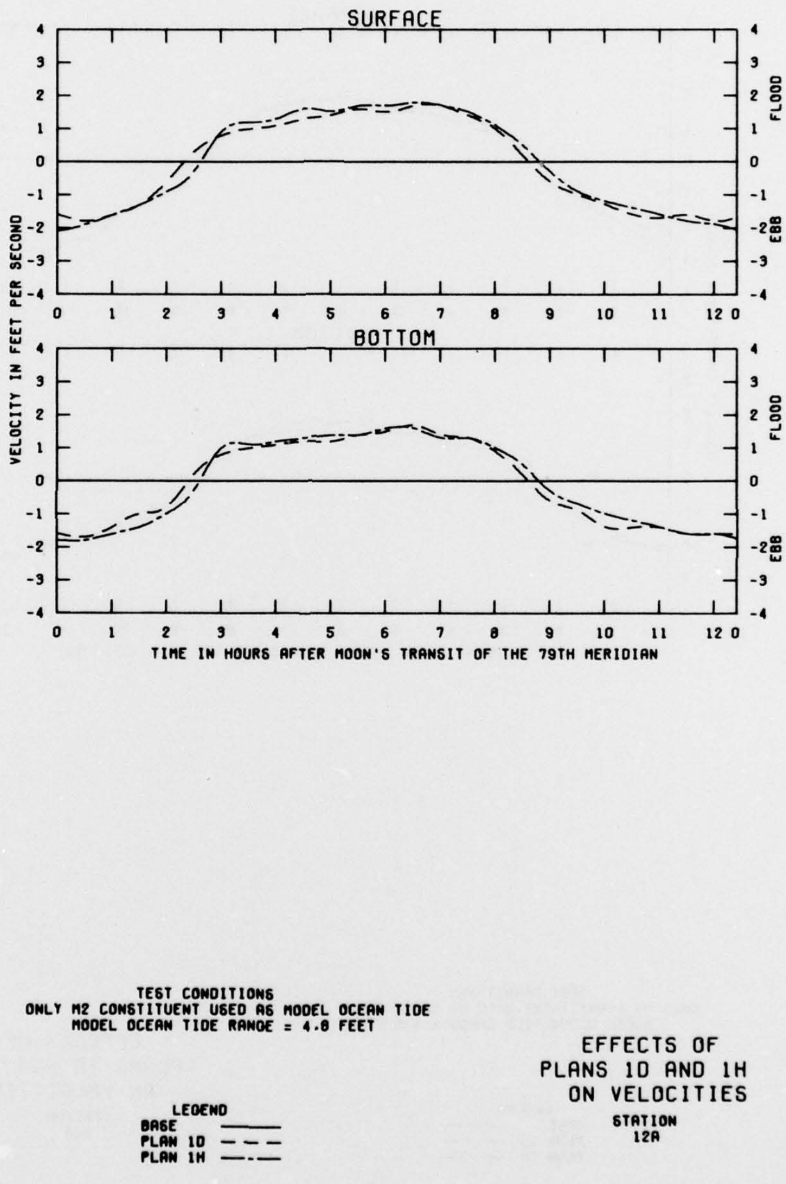


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1D — — —
PLAN 1H —·—·—

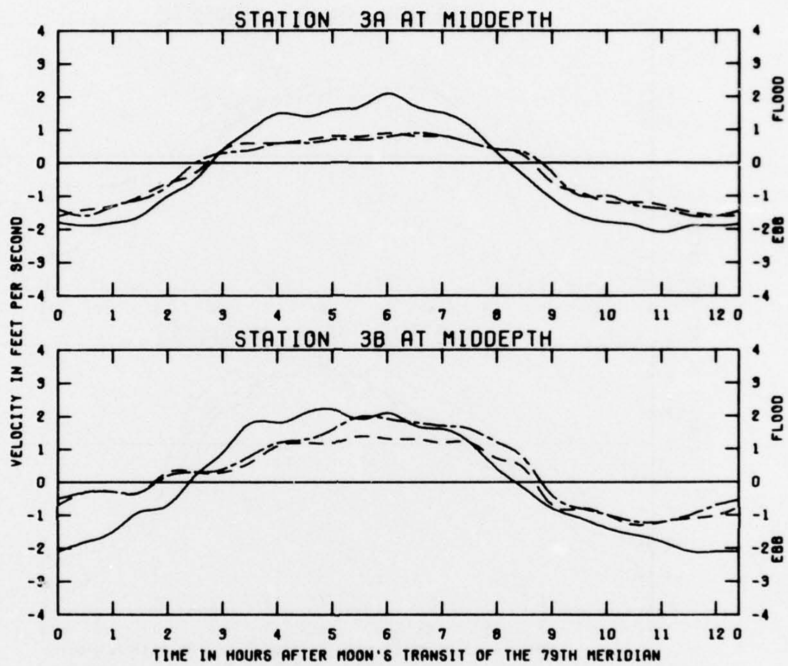
EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES

STATION
11A



EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES

STATION
12A

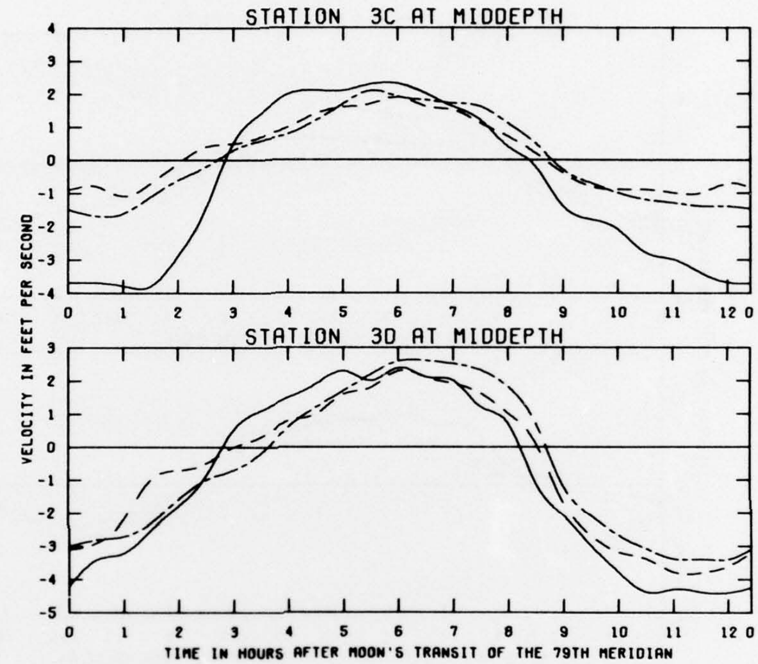


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1D — — —
PLAN 1H —·—·—

EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES

STATIONS
3A AND 3B

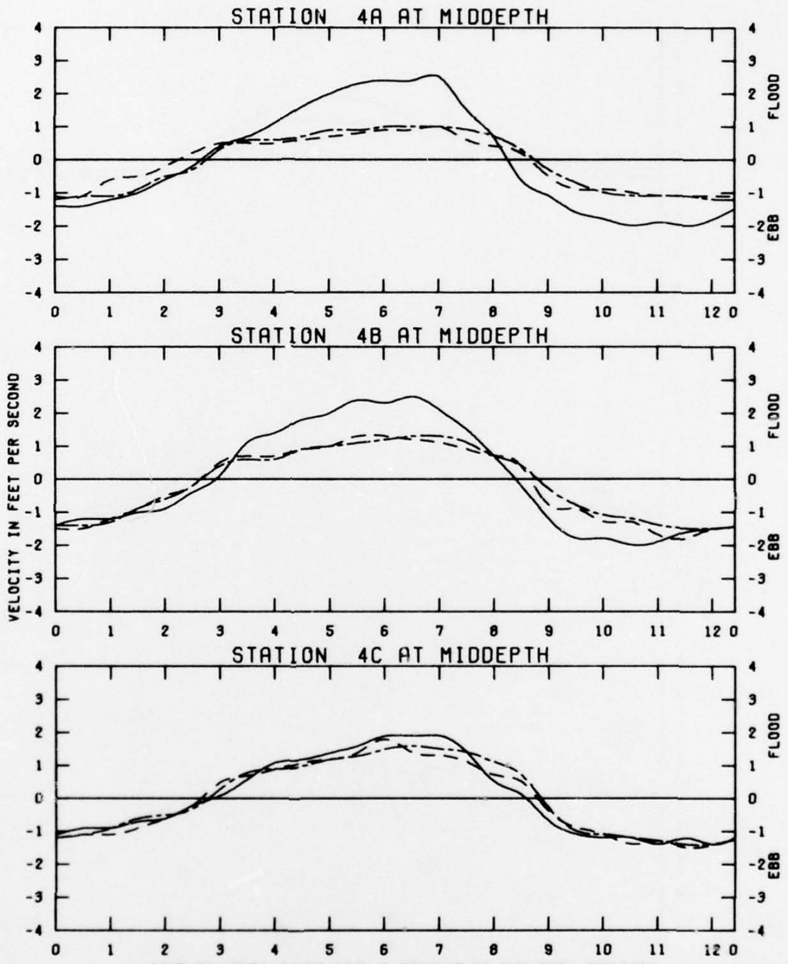


TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1D — — —
PLAN 1H —·—·—

EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES
STATIONS
3C AND 3D

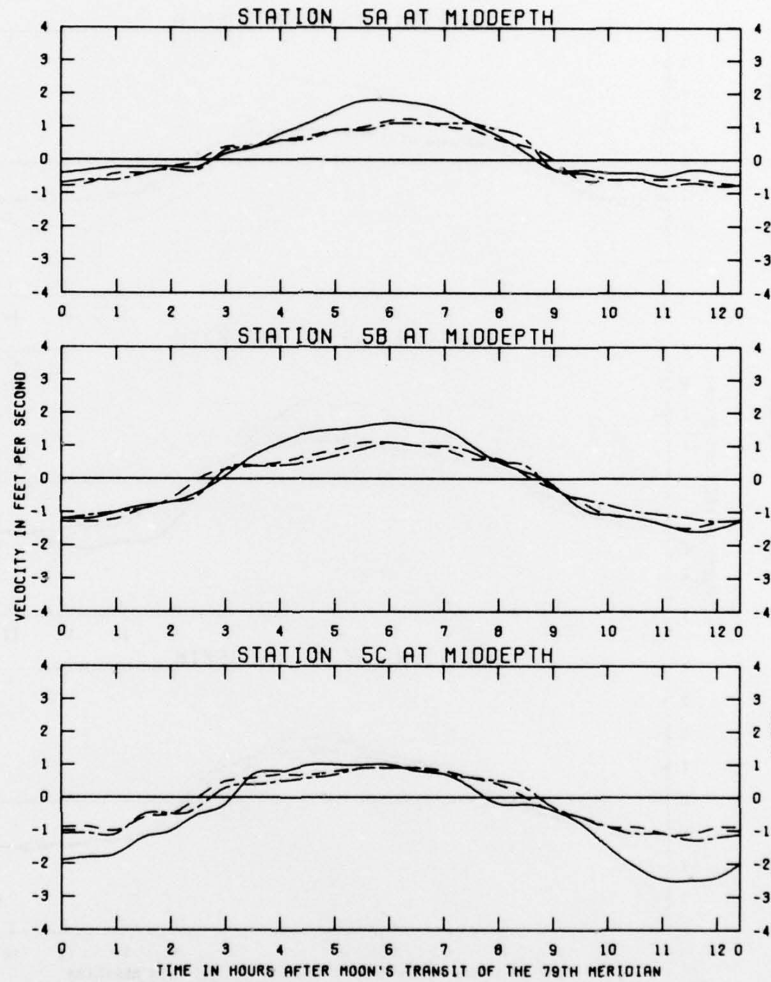
PLATE 140



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES

STATIONS
4A, 4B, AND 4C



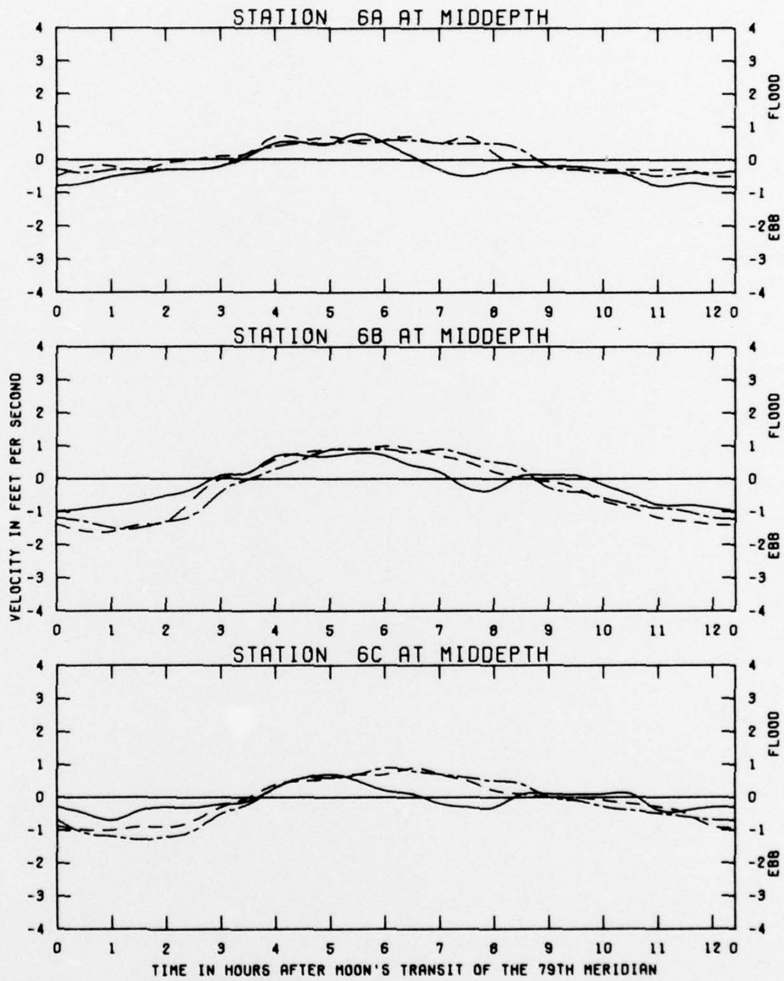
TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ————
PLAN 1D — — —
PLAN 1H —·—

EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES

STATIONS
5A, 5B, AND 5C

PLATE 142



TEST CONDITIONS
ONLY M2 CONSTITUENT USED AS MODEL OCEAN TIDE
MODEL OCEAN TIDE RANGE = 4.8 FEET

LEGEND
BASE ———
PLAN 1D – – –
PLAN 1H —·—·—

EFFECTS OF
PLANS 1D AND 1H
ON VELOCITIES
STATIONS
6A, 6B, AND 6C

PLATE 143

APPENDIX A: NOTATION

a_i	Angular speed of i^{th} constituent
a_i, a_o, b_i	Coefficients
$A_i = f_i H_i$	Amplitude of i^{th} constituent
f_i	Factor to reduce mean amplitude to year of prediction
h	Tidal height at time t_i
$\hat{h}_M(t)$	Calculated tidal elevation represented by a harmonic series of known frequencies
H_i	Mean amplitude of i^{th} constituent
H_o	Mean height above reference datum
J_1	Diurnal small lunar elliptic tidal harmonic component
K_1	Diurnal luni-solar diurnal tidal harmonic component
K_2	Semidiurnal luni-solar tidal harmonic component
L_2	Semidiurnal smaller lunar elliptic tidal harmonic component
M_1	Diurnal smaller lunar elliptic tidal harmonic component
M_2	Semidiurnal principal lunar tidal harmonic component
M_4	Quarter-diurnal shallow-water principal lunar tidal harmonic component
M_6	Sixth-diurnal shallow-water principal lunar tidal harmonic component
M_8	Eighth-diurnal shallow-water principal lunar tidal harmonic component
N	Total number of constituents
N_2	Semidiurnal larger lunar elliptic tidal harmonic component
O_1	Diurnal principal lunar tidal harmonic component
P_1	Diurnal principal solar tidal harmonic component
P_2	Semidiurnal solar component
Q_1	Diurnal larger lunar elliptic tidal harmonic component
S_2	Semidiurnal principal solar tidal harmonic component
S_4	Quarter-diurnal principal solar tidal harmonic component
S_6	Sixth-diurnal principal solar tidal harmonic component
t	Time reckoned from some initial epoch
T_2	Semidiurnal larger solar elliptic tidal harmonic component

u	An angle varying in a period of 18.61 years
V_o	An angle changing steadily at the mean speed of the constituent
$(V_o + u)_i$	Equilibrium argument of i^{th} constituent for $t = 0$
$\varepsilon(t)$	Noise
κ_i	Local epoch of i^{th} constituent or the log of the phase of the tidal constituent behind the phase of the corresponding equilibrium constituent
λ_2	Semidiurnal smaller lunar evectional tidal harmonic component
ν_2	Semidiurnal larger lunar evectional tidal harmonic component
ρ_1	Diurnal lunar component
ϕ_i	$(V_o + u)_i - \kappa_i$ = phase angle of i^{th} constituent
ω_i	Angular frequency of i^{th} constituent
OO_1	Diurnal lunar component
$2N_2$	Semidiurnal lunar elliptic second order tidal harmonic component
$2Q_1$	Diurnal lunar component

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Perry, Frederick C

Improvements for Murrells Inlet, South Carolina; hydraulic model investigation / by Frederick C. Perry, Jr., William C. Seabergh, Edgar F. Lane. Vicksburg, Miss. : U. S. Waterways Experiment Station ; Springfield, Va. : available from National Technical Information Service, 1978.

69, [271] p., 143 leaves of plates : ill. ; 27 cm. (Technical report - U. S. Army Engineer Waterways Experiment Station ; H-78-4)

Prepared for U. S. Army Engineer District, Charleston, Charleston, South Carolina.

References: p. 69.

1. Bypasses. 2. Channel stabilization. 3. Fixed-bed models. 4. Jetties. 5. Murrells Inlet. 6. Tidal inlets. 7. Tidal models. I. Lane, Edgar F., joint author. II. Seabergh, William C., joint author. III. United States. Army. Corps of Engineers. Charleston District. IV. Series: United States. Waterways Experiment Station, Vicksburg, Miss. Technical report ; H-78-4.

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